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REPORT
on Research Work

RESULTS OF ONSHORE ROUTE OBSERVATIONS OF THE OKHOTSK-KOREAN GRAY WHALE POPULATION FROM JULY TO OCTOBER 2003

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INTRODUCTION

Twenty years have already passed since G.M. Kosygin (Blokhin et al., 1985) encountered about 20 gray whales (*Eschrichtius robustus*) of the Okhotsk-Korean (Western) population in the coastal waters off NE Sakhalin Island. However, the population has not yet been thoroughly studied. According to the most recent data, this population only totals about 100-120 whales. These whales dwell off NE Sakhalin during the summer and fall seasons and have been included among the highest categories of the Red List of Endangered Animal Species published by the International Union for the Conservation of Nature (IUCN) and of Russia's Red Book.

Studies conducted previously have indicated that during the feeding period, almost the entire Okhotsk-Korean gray whale population is concentrated off the NE coast of Sakhalin, and that the littoral zone of Piltun, Chayvo, and Nyisk bays are their only summer feeding area that is presently known (Berzin et al.,1986, 1988, 1990, 1991; Weller et al.,1999, 2002; Blokhin and Burdin, 2001; Blokhin et al., 2002; Bradford, 2003).

As has been shown, the shallower coastal waters seaward of Piltun Bay are a key summer-fall feeding area for the Okhotsk-Korean gray whale population. Here the whales keep to the shallower coastal waters. This fact makes it possible to conduct a whale survey from onshore, which helped define the objectives of the onshore route whale survey performed from an automobile as the vehicle moves along the Piltun Bar coast.

The first onshore gray whale survey performed from an automobile from the Piltun Bar was performed by S. Blokhin and A. Burdin in 1988. This survey proved the potential effectiveness and low cost of such studies. The second onshore experimental automobile-based whale survey was performed by S. Blokhin in 2002 between the Okha District and the mouth of Piltun Bay. These studies led to the conclusion that the potential of this technique needed to be evaluated more fully.

In accordance with the "2003 Okhotsk-Korean Gray Whale Population Study and Monitoring Program off the NE Sakhalin Island Coast", approved by the State Fisheries Committee of the Russian Federation, a program was established to conduct full scale onshore route gray whale surveys by automobile from July to October 2003. This approach helped evaluate the potential of this technique to document distribution of whales along the coast throughout the whale feeding season.

The primary purpose of performing the onshore survey work was the study designed to quantitatively characterize and monitor the temporal and spatial distribution and abundance of western gray whales in 2003 in the vicinity of a planned barge quay that will be constructed on the coast of northeastern Sakhalin Island, Okhotsk Sea, Russia. The next scope of the work was to determine the distribution and abundance of gray whales in the Piltun area as precisely as possible, as well as to determine the population's seasonal fluctuations, the nature and patterns of its distribution, the number of females with nursing young, the time when mother-calf pairs split up, calves' transition to an independent diet, and other incidental observations of the whales' behavior and local migrations.

The onshore automobile-based survey of gray whales in the Piltun Bar area was funded by the oil production companies Exxon Neftegas Limited (ENL) and Sakhalin Energy Investment Company Limited (SEIC) using funds allocated for environmental monitoring in the Sakhalin-1 and Sakhalin-2 project implementation area.

MATERIALS

Work Area

The survey work area is located in the southern part of the Sea of Okhotsk off the NE Sakhalin Island coast. From the north, the survey area is bounded by the Odoptu Bay inlet and from the south – by the Piltun Bay inlet (**Figure** 1). The NE Sakhalin coast in the work area is made up of sand spits and ancient dunes intermittent with the scoured lowlands of the channels of previous lagoons. On the seaward side, these spits and dunes are hollowed-out and dramatically broken off facing the surfy beach, forming bluffs (**Figure** 2). In the northern part the height of these bluffs ranges mostly from 11 to 13 m. Some of the bluffs are as tall as 30 m. To the south, the height of the bluffs gradually drops off, and at the most southern point is no taller than 4 m (**Figure** 3). In the southern part, the Piltun Bar is covered with grass and tundra with severely oppressed pine, alder, and mountain ash elfin woods. To the north, the elfin woods are less oppressed, however everywhere along the coast their height does not exceed 1 m. An expansive littoral shelf extends along the coast of the entire survey area, with depths of between 1 and 10 m. The outer boundary of the littoral shelf is some 1.5-2 km from the shoreline. The littoral shelf is a complex system of underwater sand banks and bars, intermittent with deeper channels and basins. This system is formed under the action of currents and the surf, which continuously alters this system during storms. Since the first half of the summer, particularly in July, strong southerly winds are blowing, the surf waves strike the shore and the outer boundary of the littoral shelf at an oblique angle. As the surf acts on

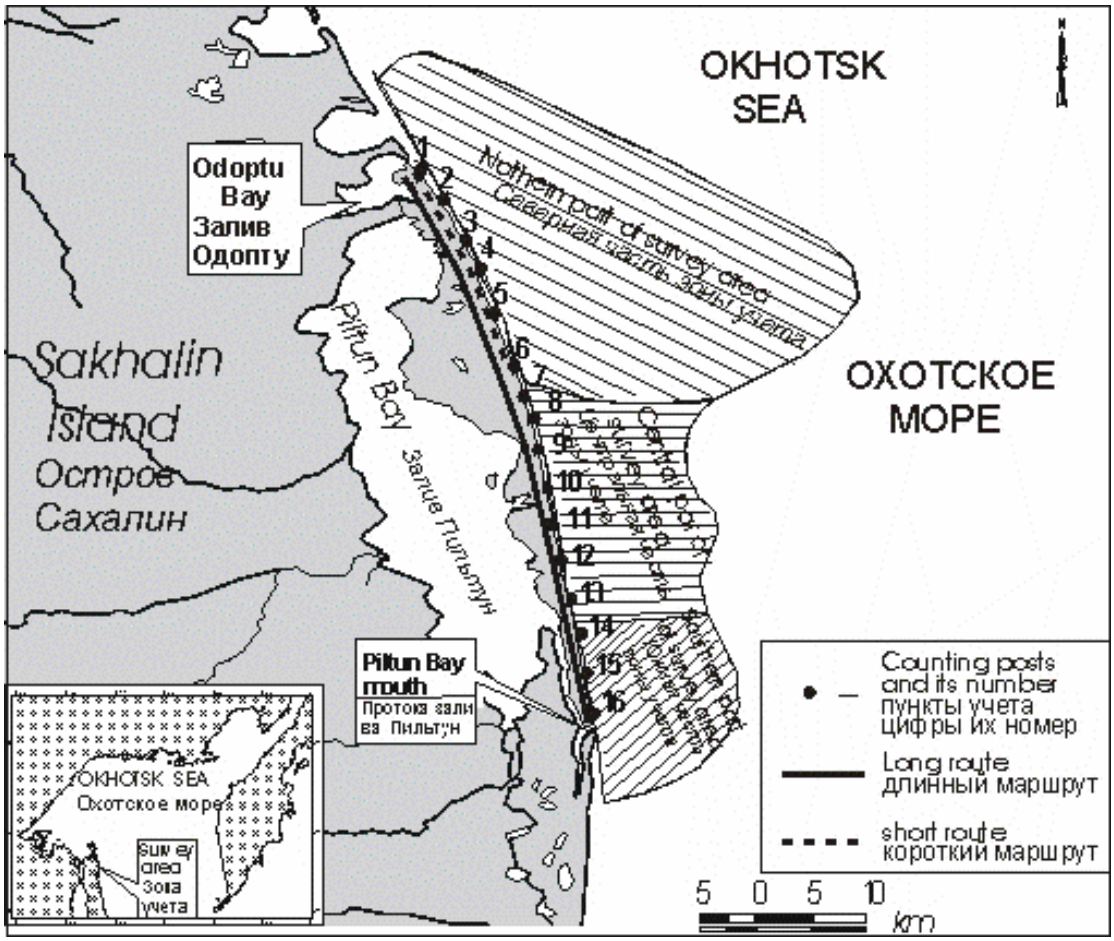


Figure 1. Layout of the Work Area off the Sakhalin Island Coast. Inset indicates location of Sakhalin Island in the Sea of Okhotsk.

the littoral shelf, two lines of wave run-up are formed. One, which is strong and obliquely angled, acts on the outer side of the littoral shelf; the other, which is substantially weaker, acts right on the shore (Figure 4).

Between the lines of wave run-up is a relatively calm area of sand banks, basins, and channels, which have egress beyond the outer boundary of the littoral shelf.

Figure 2. Topography of the northern part of the survey area.

Figure 3. Topography of the southern part of the survey area.

Figure 4. Obliquely-angled incoming surf along NE Sakhalin. Two lines of wave run-up are shown.

During the wave run-up it appears to act as a physical concentrator of benthos organisms and zooplankton, which on the outer side of the shelf are dumped by the surf waves into a relatively calm area of channels and basins between the outer and inner bars (Figure 5). Since these basins and channels have egress to the outer edge during this obliquely-angled wave run-up action, gray whales are able to penetrate into the littoral shelf area and feed. This area is exploited especially actively by mother gray whales with their young who are just beginning to feed on their own. Closer to autumn, calf gray whales who have recently become fully independent, are the more common feeders in this area. Along with the whales, bearded seal and ringed seal juveniles actively fed in the littoral shelf area during the wave run-up action in August.

Figure 5**. Benthos washed up on NE Sakhalin beaches.**

Work Periods and Conditions

During the last third of July and the first third of August, the weather in the work area was characterized by persistent and strong, southerly winds. By midday, their speeds would increase to 12-15 m/s. In combination with the cold water on the sea surface, these winds created fog over the sea, reducing visibility to 200-300 m (Figure 6). Onshore meanwhile, the weather was often clear. At midday the fog sometimes lifted and on certain days visibility was up to 5 km. During times of relatively improving visibility, the observation stations in the northern part of the route could be noted, their altitude measured, and their coordinates determined.

The survey proved to be feasible only after 13 August when relatively stable weather with good visibility had taken hold. Observations were performed on six surveys in August along the extended route between Odoptu Bay and the mouth of Piltun Bay. In addition, six shorter surveys were conducted along the route between 53°23’ and 53°13’ N. lat. Three short surveys were suspended due to worsening visibility (Table 1). A total of 17 days were missed in August due to weather unsuitable for surveying.

Figure 6. In July and early August 2003 strong and persistent southerly winds were accompanied by dense fog, which made surveying the gray whales impossible.

In September 2003 there was relatively stable weather in the work area, with worsening periods during storms in the middle and end of the month. On 5 September extended-route surveys were performed throughout the entire survey area (Odoptu Bay – the mouth of Piltun Bay) and eight observations during short-route surveys were performed in the northern part of the survey area between 53°23' and 53°13' N. lat. One extended and two short survey routes were started but not completed due to declining visibility (Table 1). A total of 15 days were missed due to weather unsuitable for surveying.

Very unstable weather with heavy storms regularly occurring in the work area was typical of October 2003. The survey proved to be feasible only during short periods of calm between the storms. Moreover, after 13 October traveling south of 53°12' N. lat. along the Piltun Bar proved to be impossible due to washout of the road along the "confluent" lake's coastal dam. In October, four extended-route surveys between Odoptu Bay and the tip of the Piltun Bar, and one short-route survey, were performed. Two observations during short-route surveys were not completed due to declining visibility (Table 1). Nine days were missed due to weather unsuitable for surveying.

Table 1. Statistics of the Onshore Route Gray Whale Survey in 2003.

	July	August	September	October	Total
Route travel duration (hours)	3.18	84.35	68.45	36.92	192.9
Observation time (hours)	2.28	33.75	33.0	17.5	86.5
Observation during good visibility (hours)	1.03	13.25	25.0	14.0	53.3
Kilometers traveled	32.1	545.4	488.4	265.8	1331.7
Number of extended routes	0	6	5	4	15
Number of short routes	3	7	10	4	24

Whale surveying was conducted for a total of 86.5 h (Table 1) over the entire season. Travel along the routes took up 192.9 h, of which 53.3 h was spent performing the survey during good or excellent visibility. During surveying along the coast, 1331.7 km were traversed. The work was most intensive in August and September, when there was good weather.

WORK METHODOLOGY

The methods for conducting the survey and recording the results were established in a methodology developed prior to commencing the survey work (Appendix 1). This methodology was prepared based on tried and tested bowhead whale coastal survey methods that have proven to be effective and reliable at Cape Barrow (Zeh et al. 1993) in a program provided by ENL on methods for conducting gray whale coastal surveys in the vicinity of Unimak Pass (Rugh 1974), and on a method for coastal surveying from the shores of the Chukotka Peninsula (Melnikov et al., 2002), which was reported and adopted at a convening of the 54th session of the International Whaling Commission's Science Committee.

The whale survey was conducted from stationary observation stations situated along the coastline (see **Figure** 1). The whale survey was performed by two surveyors. The survey field of view was monitored continuously for 15 min both with binoculars and without. In most cases, each surveyor monitored either the northern or southern half of the survey field of view.

When one of the surveyors sighted a whale, the other would record the sighting location parameters on the survey sheet. The direction in which the whales were sighted was determined using the binoculars' built-in compass and the number of division marks on the binoculars' vertical scale between the line of the horizon and the sighted animal was recorded. Then the sighted whale's or whales' subsequent emersions from the water would be tracked, and their exact number would be determined. If one of the surveyors found it necessary to pinpoint the number of whales in a group, or the pattern of their behavior, especially when there was a large number of whales in his survey field of view, the other surveyor would

monitor both the survey fields of view. This was done both to check one another's work and due to the requirement that groups of whales be observed for a long time in order to pinpoint the number of whales in groups or the exact nature of their behavior.

During the survey, the possibility of counting the same whales twice proved to be a serious challenge. To avoid double-counting whales in survey sector of station, we kept comparing whale immersion parameters, their azimuth and the number of division marks on the binoculars with those recorded earlier on a paper table. Special attention was given to boundary zones of the adjacent survey sectors. In the border areas between neighboring observation stations double- counting of whales was avoided by identifying already counted whales by their azimuth, distance from shore, the number of whales in the group, behavioral characteristics, etc. Moreover, to prevent counting the same whales twice, the surveyors had to exchange information constantly. If there was a question as to whether the given whales had been previously counted, duplicates could be detected by evaluating their coordinates.

In good visibility, not only can the survey zones of adjacent observation stations be seen, but also ones farther away, depending on the height of the observation station.

To avoid repeated counting of the same whales, observations were not made and whales were not counted outside the working survey sector and the boundary zones of the adjacent survey sectors. It was assumed that the whales in these zones had either been recorded previously at observation stations that they had already passed, or that they would be recorded later as they moved from one observation station to another.

To avoid missing any whales located in the surf zone, where their detection can be quite difficult, the coastal waters were monitored from the vehicle while traveling from one observation station to another.

To avoid counting them twice, it was necessary to keep comparing whale immersion parameters with those recorded earlier on the paper table. Therefore during surveying the voice recorder proved to be not very useful, since using it during the observation process would have made it difficult to compare to voice recordings made earlier. When processing the voice recording data, there was great difficulty deciphering the recordings that were made against the wind or surf noise. Written records on the survey sheet made it possible to continuously compare the immersions of newly discovered whales with those of whales that had been recorded earlier. Moreover, to prevent counting the same whales twice, the surveyors had to exchange information constantly. If there was a question as to whether the given whales had previously been counted, duplicates could be detected by evaluating their coordinates. And to avoid missing any whales located in the surf zone, where their detection can be quite difficult,

the coastal waters were monitored from the vehicle while traveling from one observation station to another.

The survey results were recorded in the form of a chart (Appendix 2), where the following parameters were entered:

- whale survey start time, rounded to the nearest minute;
- survey conditions – visibility, weather conditions, wind speed and direction, the presence of white-caps among the waves, glare, water craft or airplanes; and
- for animals that were sighted, a record was made of their species, quantity, vertical angle and azimuth of their location, direction of motion, and behavioral characteristics (if such were observed). For each individual whale or group of whales, their parameters were entered on a separate line. Later on, after office analysis, the calculated distance to the sighted animal and the animal's coordinates were entered on the survey chart.

Special 7x Steiner Commander III and Soligor binoculars with a built-in compass and vertical and horizontal measurement scales were used for the survey. During calibration of these respective binoculars, we have not found a distinction between the reticular of the binoculars, but we could distinguish between the magnetic compass of the binoculars. There was a systematic mistake of 4° + in the Steiner Commander III. During field observations we corrected this immediately when noting the azimuth target on paper. Also, the Soligor was sensitive to the metal of the vehicle. To prevent this, the observer using the Soligor binoculars worked standing on the cabin of the truck.

The personal navigator Trex LEGEND was used to determine the coordinates of the observation stations. For obtaining station coordinates, we used an average of three measurements.

A surveyor's table, which held the survey chart, code tables, watch, and a pencil, was prepared for ease of recording the parameters. During the survey photographic cameras were used to photograph conditions, the animals, and any unusual phenomena or animal behavior.

Distance between the Observation Stations

The distance between the observation stations is an important factor affecting the survey's effectiveness. When visibility is good or excellent, even from low-lying surveying locations, one can monitor distance up to 10 km, which significantly overlaps the fields of view of neighboring observation stations. However, when the distance between observation stations is more than 5 km, especially if the observation station altitude is not high, the surf

zone cannot be monitored, where the probability of missing whales is particularly high. In addition, the possibility of missing whales is greater if they are a great distance from the observation station, especially when visibility is not good. If the whales go out more than 3 km from the observation station, the number of animals in the group and their behavioral characteristics are hard to distinguish. At distances of more than 5 km, the magnitude of instrumentation error increases sharply and the accuracy of determining the coordinates of locations where sighted whales emerged falls off. When there is a small distance between observation stations, the likelihood of double-counts increases. Therefore, selecting the distance between observation stations is always a compromise between the allowable omission and the allowable double-count. A distance of 3-4 km between observation stations, depending on local topography, was chosen as optimal. The actual distance between observation stations was largely determined by the physical features of the coast and the altitude of the observation stations, but in all cases the fields of view of neighboring observation stations partially overlapped one another. However, one key goal of this work was to identify areas with low density of whales, and potential double-counting of whales would only tend to eliminate potential areas for consideration as candidates for temporary operational sites.

Observation Station Altitude

The altitude from which the survey is conducted is a very important parameter affecting the size of the field of view, the accuracy of determining the distance to the sighted animal, and consequently the accuracy of determining its coordinates. Therefore, the observation stations chosen were as high up as possible, taking into account the possibility of monitoring the surf zone. Along the northern segment of the route the observation stations were on coastal cliffs 12 to 30 m above sea level (**Figure** 2; Table 2), on the highest and most level sites possible from which at least 3-4 km of the surf zone could be seen in each direction. Along the southern segment of the route, where the shore elevation varied from 3 to 7 m above sea level, in order to increase the field of view, the surveys were conducted from the roof of the automobile, whose 3 m height was factored into distance calculations (**Figure** 3). The height of the observer above the ground or the top of the vehicle was not considered.

Table 2. Station location and estimated station height.

Station Number	Latitude	Longitude	Elevation (m)	Station Number	Altitude	Longitude	Elevation (m)
1	53,41254	143,1528	11,5	9*	53,125	143,27	9,5
2	53,3783	143,172	16,5	10*	53,08832	143,27794	7
3	53,3349	143,19615	18	11*	53,05222	143,28444	10,9
4	53,30759	143,20932	20,7	12*	53,01497	143,29218	7
5	53,26347	143,22725	30	13	52,97417	143,30194	8,6
6	53,20853	143,24782	18	14*	52,93745	143,31041	4,7
7	53,17968	143,25587	14,8	15*	52,90213	143,3174	10
8*	53,15596	143,26337	7,2	16	52,85822	143,32468	8

* include 3 m of the height of truck.

At each station, the distance between the station and point of location was determined using a personal navigator. The vertical angle from the surf line to the highest point of the observation station was determined using the vertical reticule of the binoculars (**Figure** 7). Read-outs were taken from 3-5 points to check the accuracy of the determined observation station altitude.

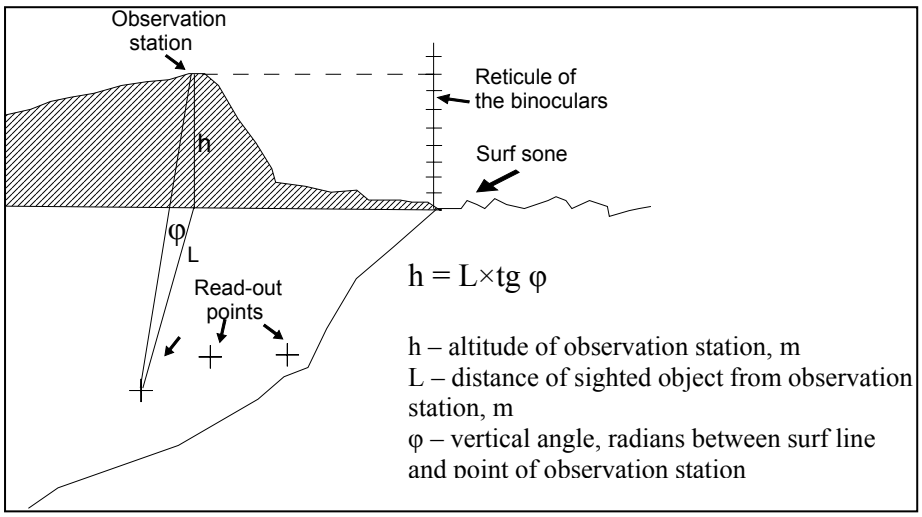
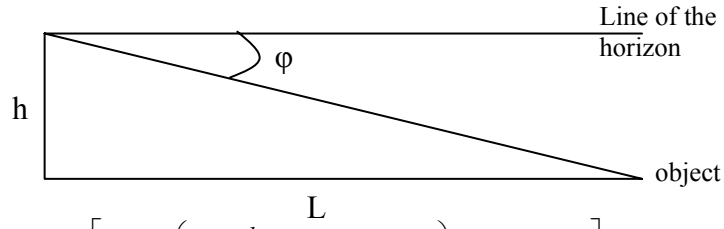


Figure 7. Diagram for determining observation station altitude.

Determining Whales' Coordinates

The binoculars' built-in compass made it possible to determine the horizontal angle (azimuth) – that is, the target direction from zero of the magnetic pole. Using the binoculars' vertical scale, the target's position angle relative to the line of the horizon was determined. The target's position angle and the instrument's elevation above sea level made it possible to determine the distance from the observation station to the whales (**Figure** 8). In processing the obtained results, we reasoned that the binoculars' grid scale is graduated in radians, and that one division mark on the binoculars' scale equals 0.001 radian. From an altitude of 5-30

m, where the observation points were situated, a distance up to 5 km could be determined quite accurately. When determining distances from any height, the error rises sharply if the target is located near the horizon line (**Figure** 9). In this case, a difference of 0.5 of the binoculars' vertical scale division, which is hard for the eye to discern, covers a distance of 2 km. From a height of 5 m, the distance is not specified in the Excel calculations if the target is located 1.5 vertical scale divisions below the horizon line in the binoculars and farther than 5 km. With an increase in the height of the observation station, the possibility of determining the distance to the whales improves. From a height of 30 m, it is theoretically possible to calculate a distance up to 15.5 km. However, it is possible to calculate the distance to the target if it is 3.5 scale divisions below the horizon line in the binoculars.



$$L = \left[\arcsin\left(\frac{r_3 + h}{r_3} \times \sin\left(\pi/2 - \varphi\right) \right) - \left(\pi/2 - \varphi\right) \right] \times r_3$$, where:

L – distance to the sighted object, m;
r_3 – radius of the Earth (6,371,200 m);
h – elevation of the observation station, m;
φ –angle to the sighted object, rad.

Figure 8. Method for measuring the distance from the observation station to the sighted object.

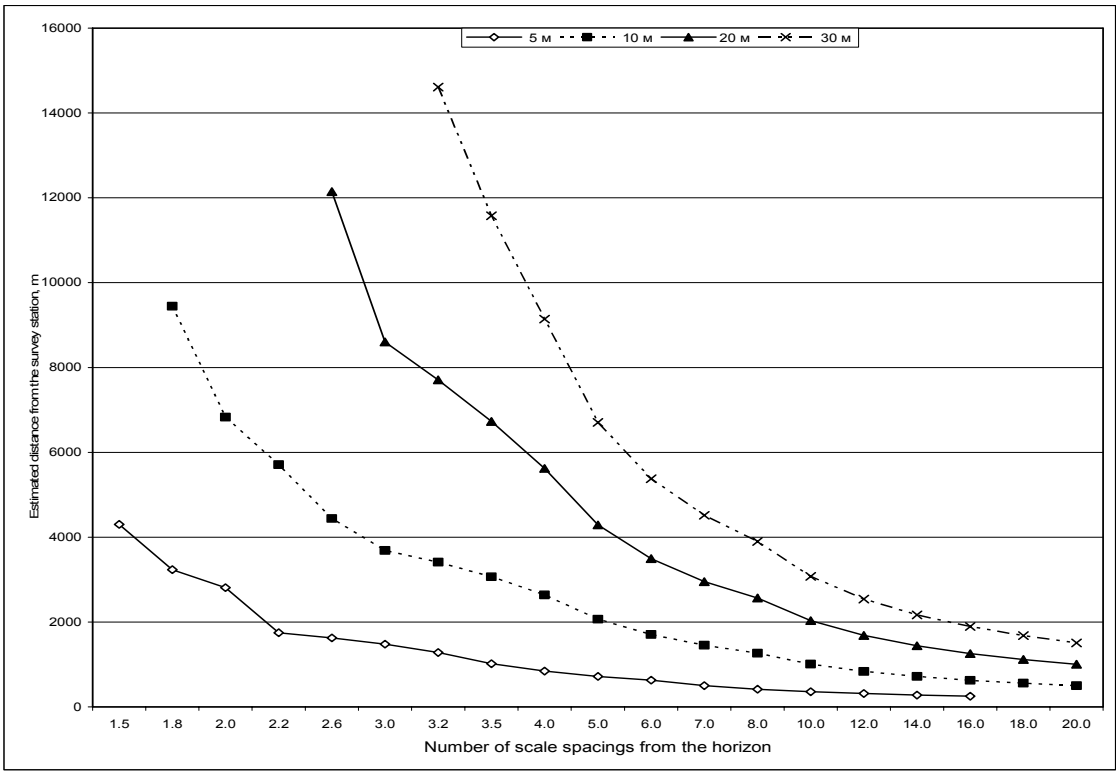
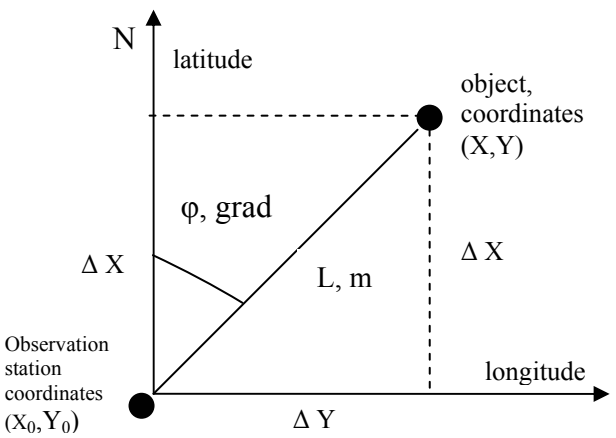


Figure 9. Analysis of possibility to estimate distances through angles determined by reticule of binocular.

The method for determining the distance to the whales by counting spacings on the binoculars' vertical scale starting at the line of the horizon is inapplicable when visibility is poor and the line of the horizon is not visible.

The geographic coordinates of the observation stations were determined using a personal GPS navigator. Based on the azimuth and the distance to the whale from the observation station, the whale's coordinates were calculated (**Figure** 10).



(X_0,Y_0) – coordinates of the observation point,
(X,Y) – coordinates of the sighted object,
L – distance to the sighted object,
φ – azimuth to the object,
Δ X and ΔY – change in the coordinates, m.

$\Delta X = L \times \sin(90-\varphi)$, $\Delta Y = L \times \cos(90-\varphi)$

Figure 10. Method for determining the geographic coordinates of the whales' surface emersions.

To convert from the metric system to the geographic coordinates system, it was assumed that 1 nautical mile (1,863 m) equals 1 longitudinal minute. The equivalent in degrees of 1 m on the earth's surface was determined to be:

for latitude : $1м = \dfrac{1°}{60 \times 1863} = k_X$,

for longitude: $1м = \dfrac{180°}{\pi \times r_3 \times \sin(90° - \alpha)} = k_Y$,

where: r_3 – the Earth's radius (6,371,200 m);
α – latitude of the observation station.

The coordinates of the sighted object are calculated from the formulas:

$$X = X_0 + L \times \sin(90-\varphi) \times k_X$$
$$Y = Y_0 + L \times \cos(90-\varphi) \times k_Y$$

For graphic mapping of the calculated coordinates of the animal's position and for simplifying how they are used in the Geographic Information System (e.g. ArcView 3.2a) a conversion was made to the geographic coordinates system. In doing so it was assumed that along the entire extent of the route, the angle formed by the direction to the magnetic pole and the latitude equaled 90° (see Figure 10).

Determining Distance between the Whales' Location and the Shoreline

For each observation station, the direction of the perpendicular to the shoreline was calculated. Since the shoreline in the survey area generally runs NW to SE, the angle of the perpendicular was determined using the formula:

$$\alpha = \frac{(\alpha_N + \alpha_S) - 360°}{2},$$

where: a – directional angle of the perpendicular to the shore
α_N – azimuth of the shoreline to the north;
α_S - azimuth of the shoreline to the south.

The distance between the sighted object and the shore was calculated using the formula:

$$d = L \times \cos(\alpha - \varphi),$$

where: d – the distance between the sighted object and the shore;
L – the estimated distance to the sighted object;
α – the directional angle of the perpendicular to the shore;
φ – the azimuth to the sighted object.

RESULTS AND DISCUSSION

In light of the diversity of issues examined here and to avoid the inevitable redundancies and reintroductions of the subject matter when discussing the obtained data, both the results and a discussion of those results have been combined into one section.

Distribution and Abundance of Gray Whales over the Entire Survey Area.

July. Throughout the survey area, the whale survey proved to be impossible during July due to persistent fog and strong southerly winds. Therefore, July whale surveys were incomplete due to poor visibility and were not considered in the further analysis.

August. As in July, during the first 10 days of August, the gray whale survey was impossible, at first due to fog and rain, and later due to a heavy storm that had arisen from a typhoon and made its way into the Sea of Okhotsk.

The first gray whale survey over the entire survey area was finally conducted on 12 August. This survey was conducted during stormy weather and strong surf conditions, and therefore nothing more was done with the obtained results. The first gray whale survey which was conducted throughout the entire survey area under good visibility conditions occurred on 13 August (Figure 11, Table 3).

Table 3. Whale Counts throughout the Entire Survey Area in August 2003.

Date	Whales counted	
	Gray	Minke
08/13/03	51	0
08/18/03	68	0
08/19/03	42	0
08/26/03	62	2
08/28/03	63	1
On average	57	

On 14 and 15 August at observation stations 2 and 3, single gray whales and groups of up to four gray whales were observed traveling from the north. The whales were moving quickly in a southerly direction without stopping or slowing down, about 2-7 km from the shore (Table 4). The nature of their motion, the fact that they were moving in one direction, and their infrequent displays of their tail fan were very reminiscent of their behavior at times of migration. In total, 13 whales were counted during eight 15-minute whale observations. Bearing in mind the brevity of our surveys which were conducted on 15 August under visibility conditions that were not very conducive to whale surveying, ultimately forcing the survey to be suspended, there were many more gray whales traveling southward than what was counted.

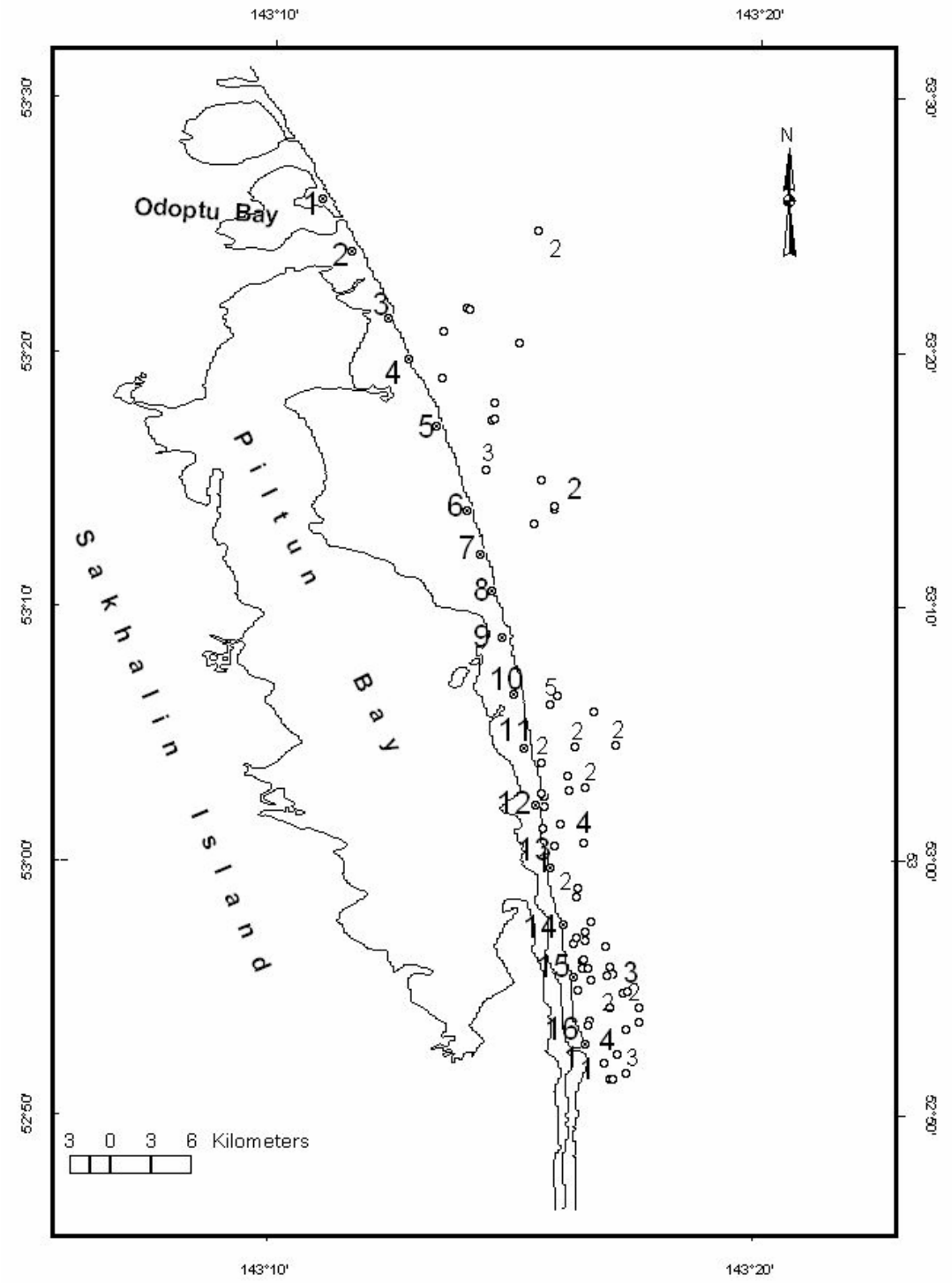


Figure 11 Results of 13 August 2003 Gray Whale Survey. The observation stations are marked by a circle with a dot; the numerals indicate the observation station number. Single whales are indicated by a circle without a dot; the numerals indicate the number of whales in groups.

Table 4. Survey of Whales Traveling Southward.

Date	Observation station	Visibility	Survey time	Survey duration (min.)	Whales counted	Distance from shore, km	Direction of motion
08/14	2	VrGood	14:07	15	4	6.6	S rapidly
08/14	3	VrGood	14:41	15	1	2.7	S rapidly
08/14	4	VrGood	15:06	15	1	4.5	S rapidly
08/15	2	FR	9:45	15	3	2.1	S rapidly
08/15	3	FR	10:15	15	1	2.9	S rapidly
08/15	4	FR	10:40	15	1	2.1	S rapidly
08/15	1	PR	16:42	15	1	2.4	S rapidly
08/15	2	PR	17:20	15	1	2.4	S rapidly

During the second 10 days of August the vast majority of gray whales were in the southern part of the survey area near the mouth of Piltun Bay (Figure 11, Figure 12, Figure 13). During this time the whales preferred to feed along the littoral shelf close to shore. In the central part of the survey area near observation stations 7 – 10, there were few whales, and only a small number of them in the northern part of the survey area.

During the final 10 days of August, despite the fact that the greatest number of animals was once again near the mouth of the Piltun Bay, the abundance of whales in the central and northern parts of the survey area was noted to increase. Thus, on 26 August a local gathering of whales was observed near observation stations 5 and 6 (Figure 14, Figure 15), and was again spotted on 28 August near observation stations 3 – 5.

September. The trend noted in late August for the abundance of gray whales to increase in the central and northern parts of the survey area, continued to develop during the first 10 days of September (Figure 16, Figure 17, Table 5). A gathering of whales spotted in late August near observation station 6, and then near observation station 5, continued its gradual and coordinated migration northward, and by 5 September the whales were mostly in the Odoptu Bay area between observation stations 2 and 4. However, by 6 September there were few of them left near observation stations 2 – 4 and their group had appeared in the vicinity of observation stations 6-8. This gave the impression that some of the whales were moving northward, to the north of Odoptu Bay, and the others were returning to the vicinity of observation stations 6-8.

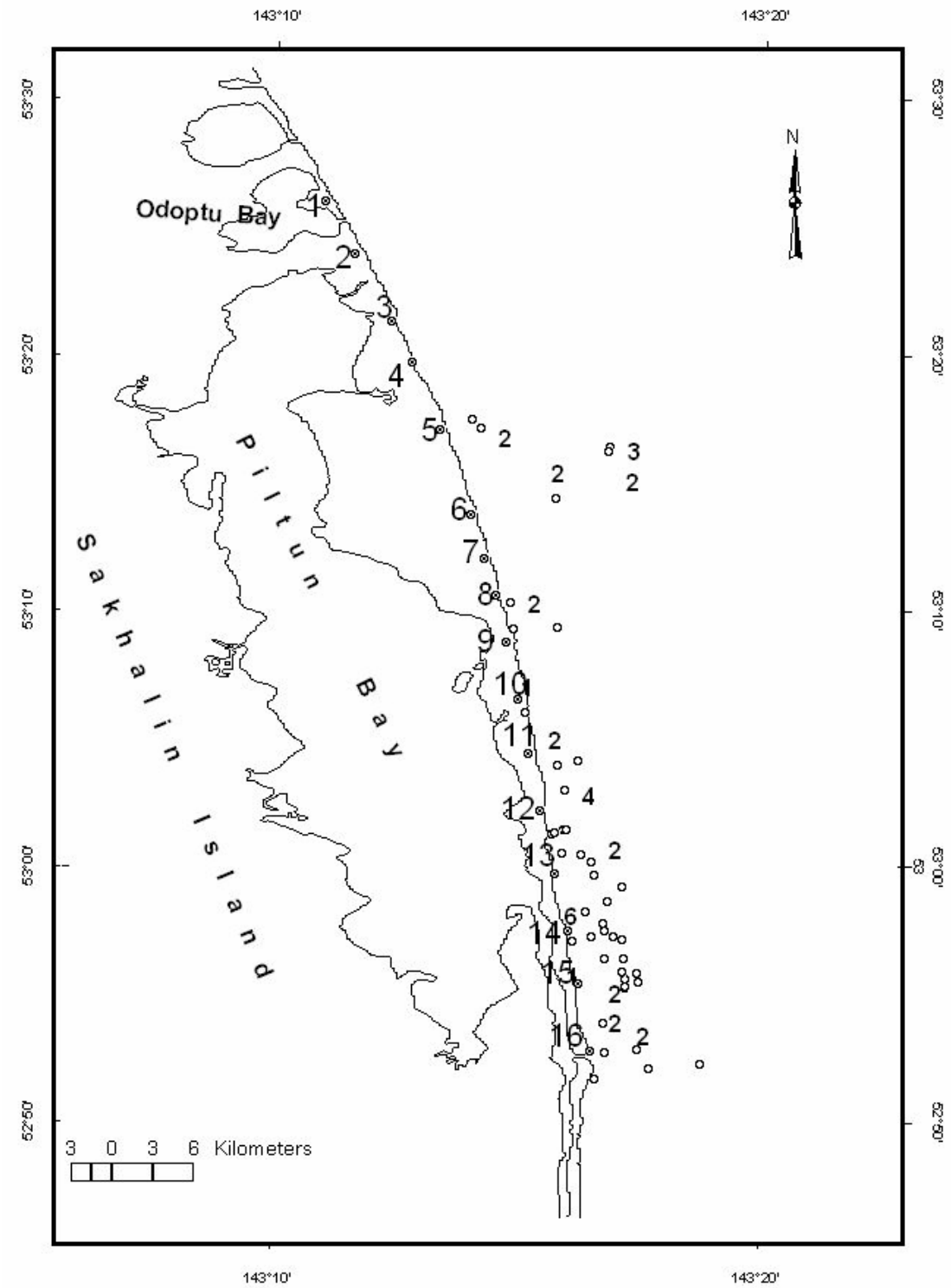


Figure 12. Results of 18 August 2003 Gray Whale Survey. Designations same as in Figure 11.

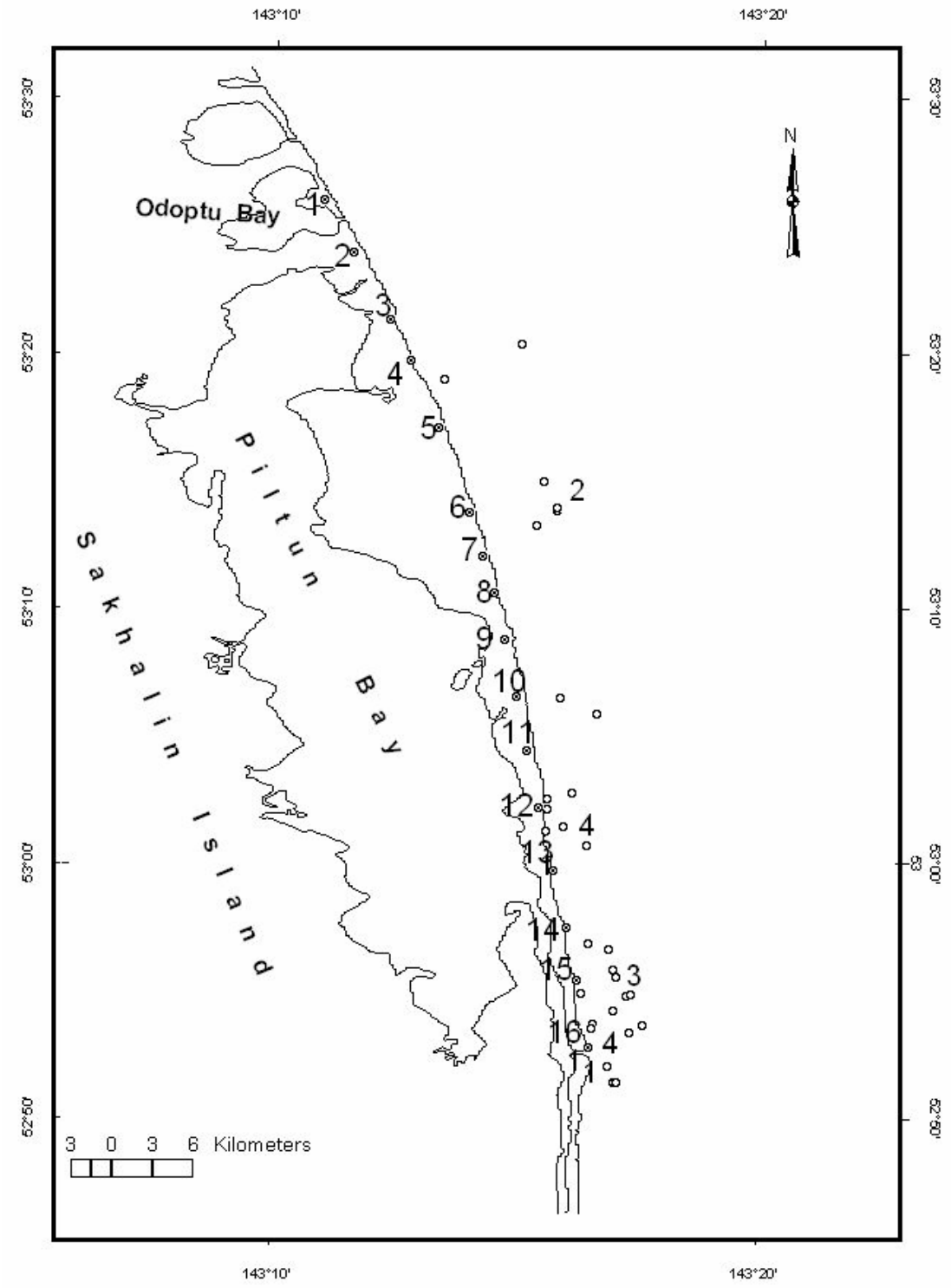


Figure 13. Results of 19 August 2003 Gray Whale Survey. Designations same as in Figure 12.

Table 5. Whale Counts over Extended Routes in September 2003.

Date	Gray whales counted
09/05/03	59
09/06/03	55
09/13/03	70
09/21/03	63
09/23/03	63
On average	62

Due to difficult weather conditions associated with a seasonal typhoon's entering the Sea of Okhotsk during the second third of September, only one survey could be performed along the extended route, on September 13th. Seventy whales were counted. Except for the extreme northern part, the whales were evenly distributed throughout the entire survey area (Figure 18).

During the last third of the month complete surveys were conducted on 21 and 23 September (Figure 19, Figure 20). The same number of animals was counted both times – 63 individuals. Again, as in early September, the number of whales in the northern part of the survey area was noted to have increased, where the whales kept in a chain formation along the outer boundary of the zone of turbidity, which the waves had stirred up from the sand banks. At the mouth of the Piltun Bay only 12 whales were sighted. In the central part of the survey area, aside from the occasional single whale, there were no whales.

And so, from late August through the end of September there were continuous, slow migrations of gray whale groupings northward along the shore of the Piltun Bar to the Odoptu Bay channel and back again. Beginning in early September and throughout the month, the abundance of gray whales in the northern part of the survey area grew, while in the southern part it decreased.

OCTOBER. During the first third of the month (4 October) 36 whales were counted along the extended route (Figure 21, Table 6). The small number of whales counted can be explained by the fact that a significant number were probably missed due to the high breaking waves during the survey period. Moreover, the survey was performed immediately after a severe storm, during which time, according to our observations, gray whales move away from the shore. The next day – 5 October, as during most of the season, again 60 gray whales were counted (Figure 22).

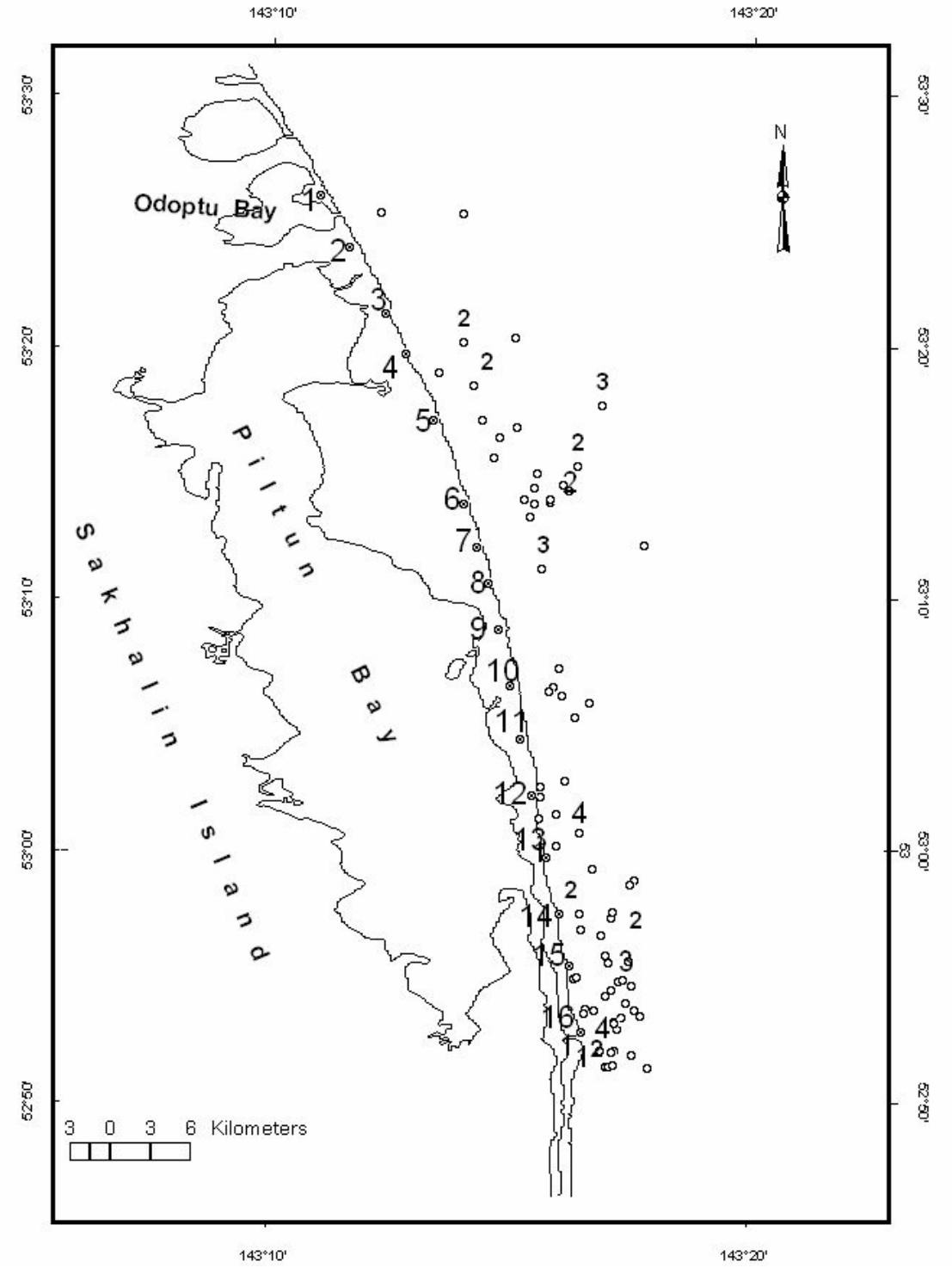


Figure 14. Results of 26 August 2003 Gray Whale Survey. Designations same as in Figure 11.

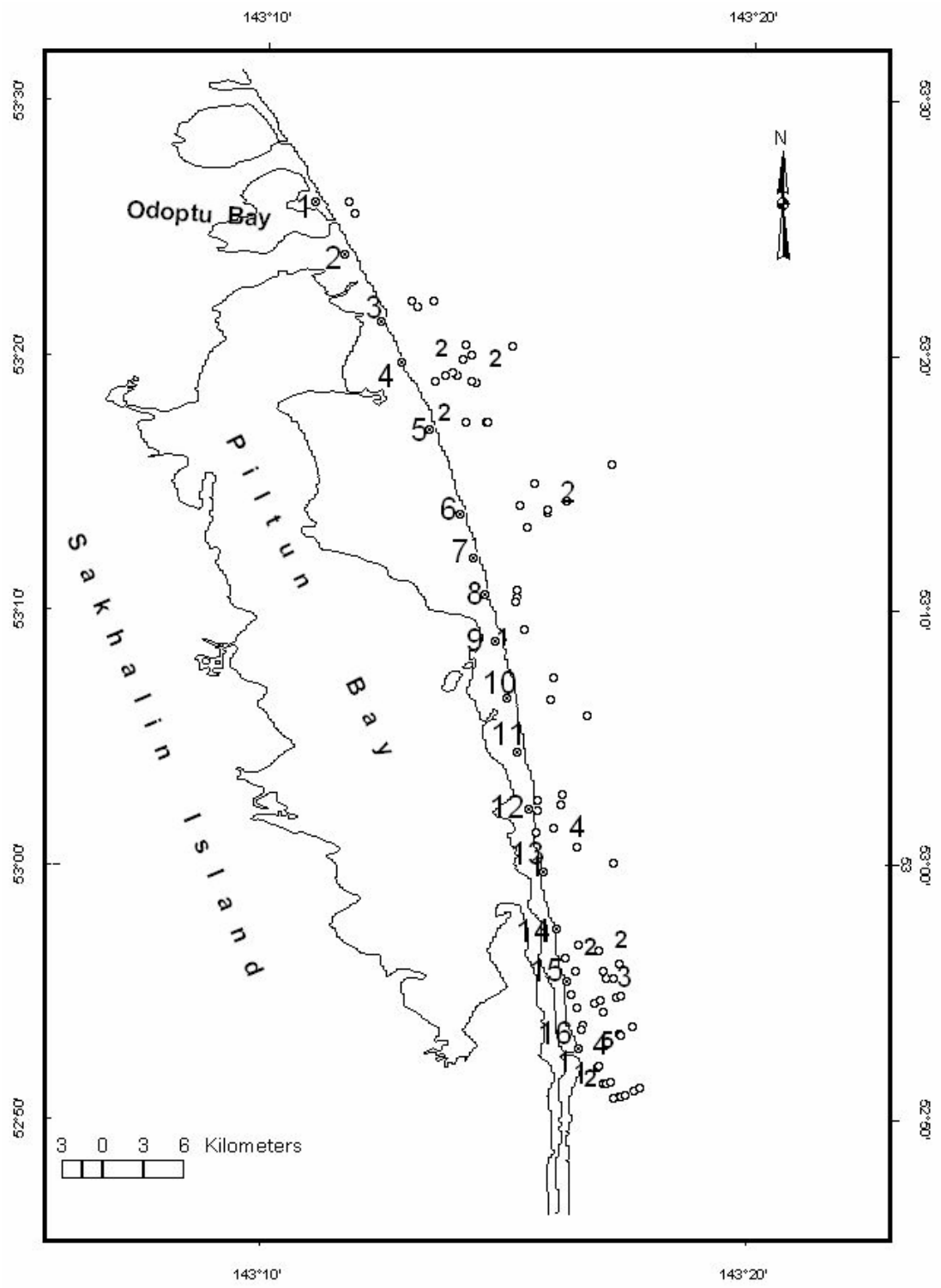


Figure 15. Results of 28 August 2003 Gray Whale Survey. Designations same as in Figure 11.

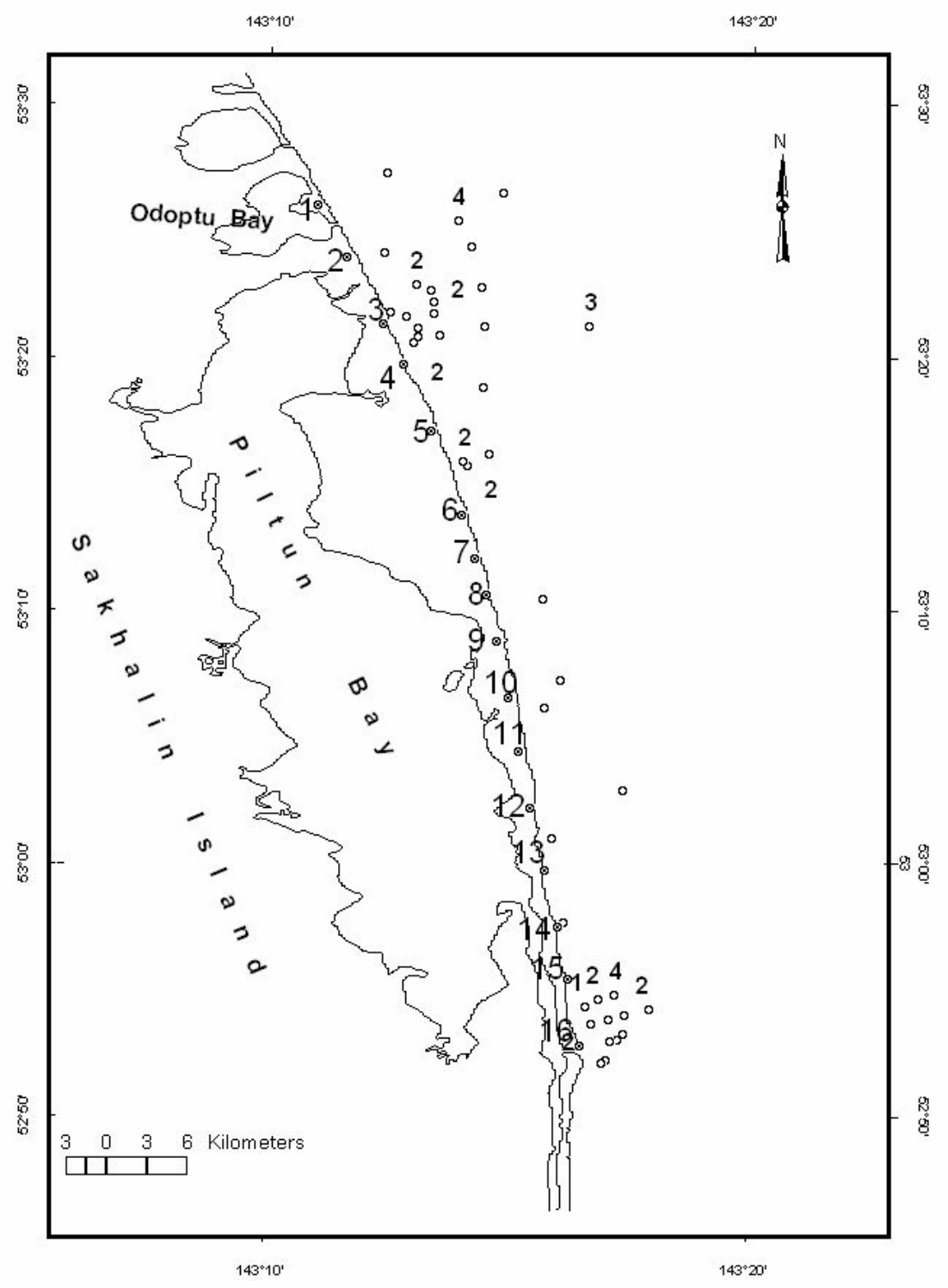


Figure 16. Results of 5 September 2003 Gray Whale Survey. Designations same as in Figure 11.

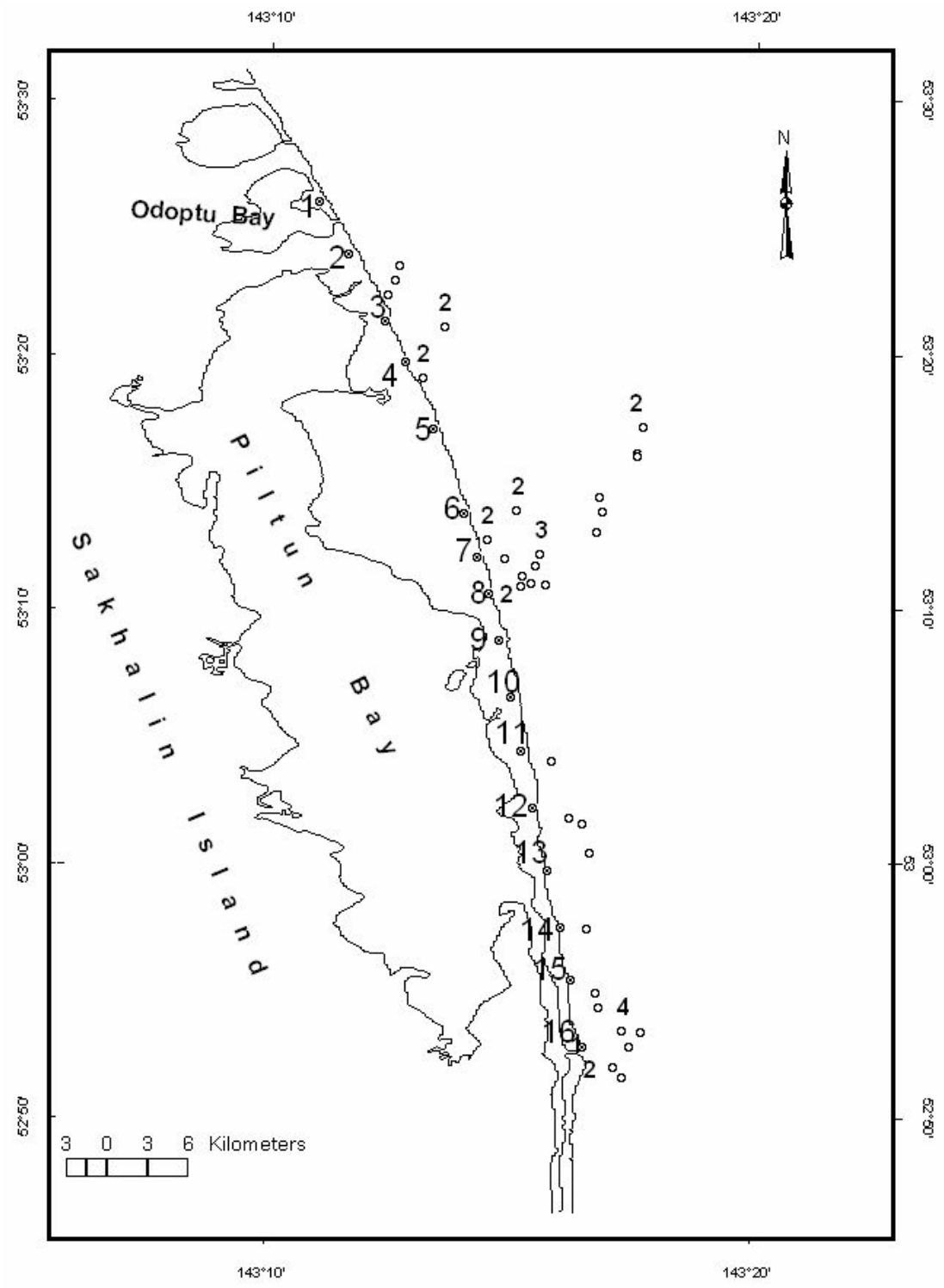


Figure 17. Results of 6 September 2003 Gray Whale Survey. Designations same as in Figure 11.

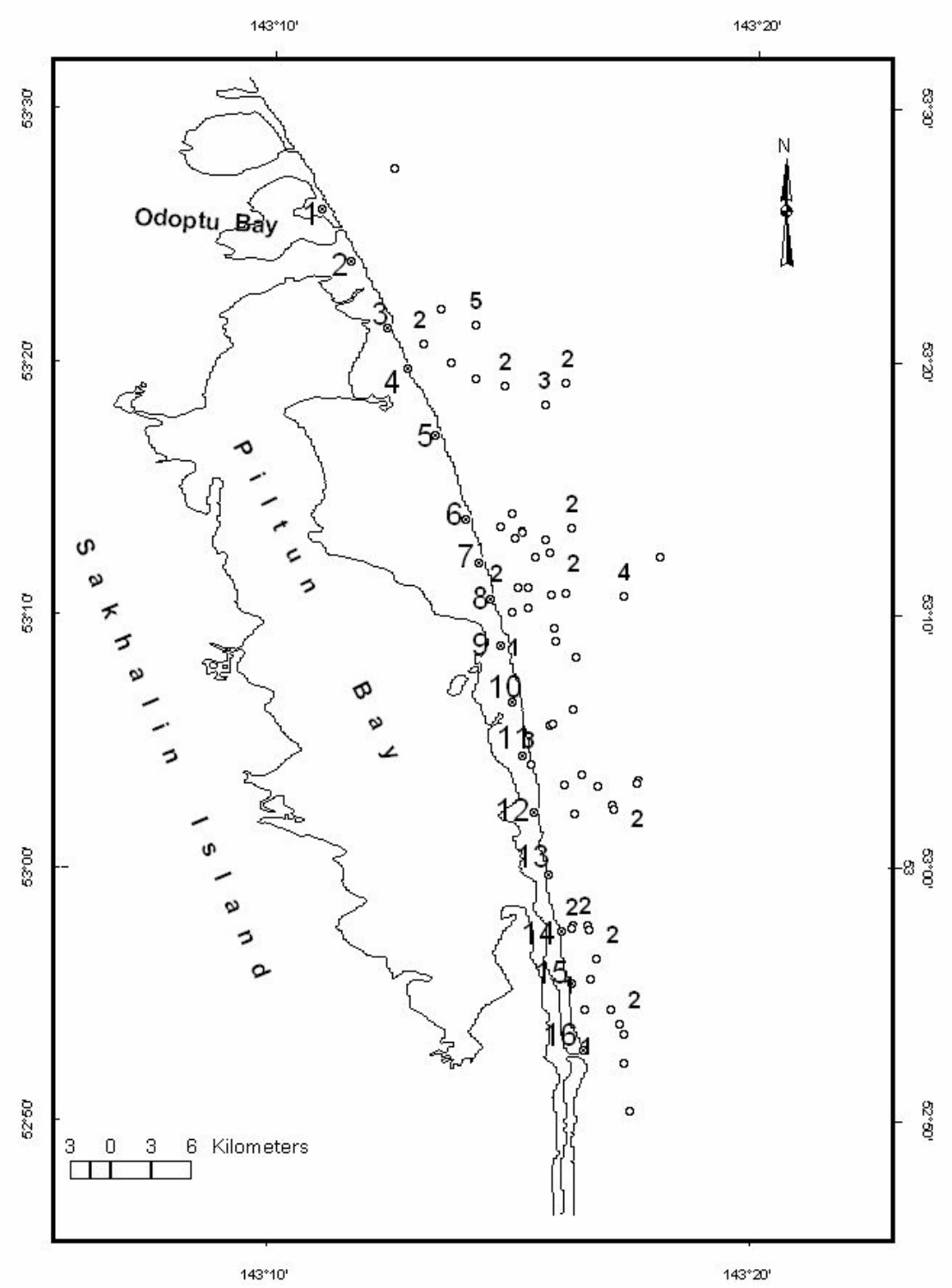


Figure 18. Results of 13 September 2003 Gray Whale Survey. Designations same as in Figure 11.

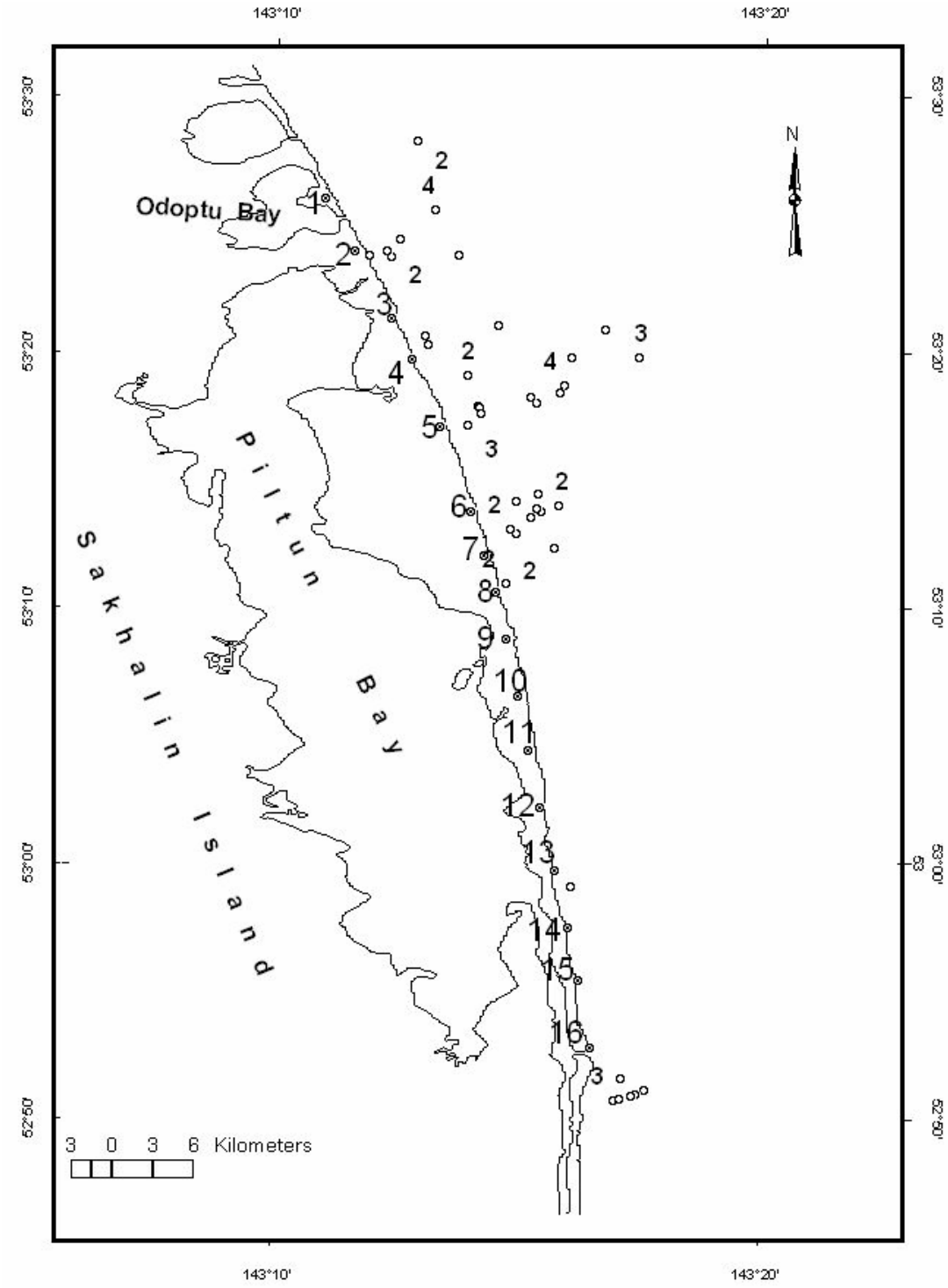


Figure 19. Results of 21 September 2003 Gray Whale Survey. Designations same as in Figure 11.

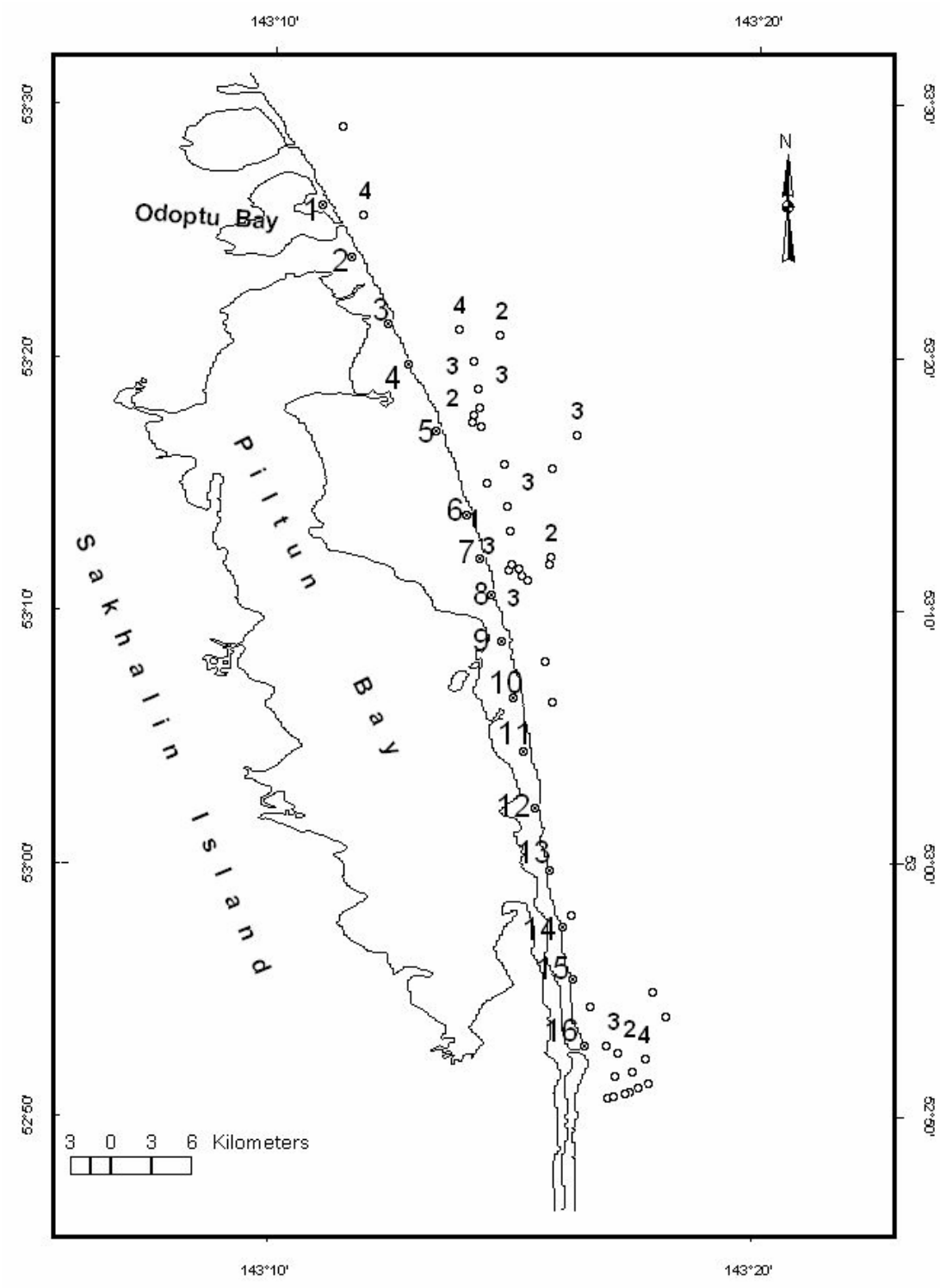


Figure 20. Results of 23 September 2003 Gray Whale Survey. Designations same as in Figure 11.

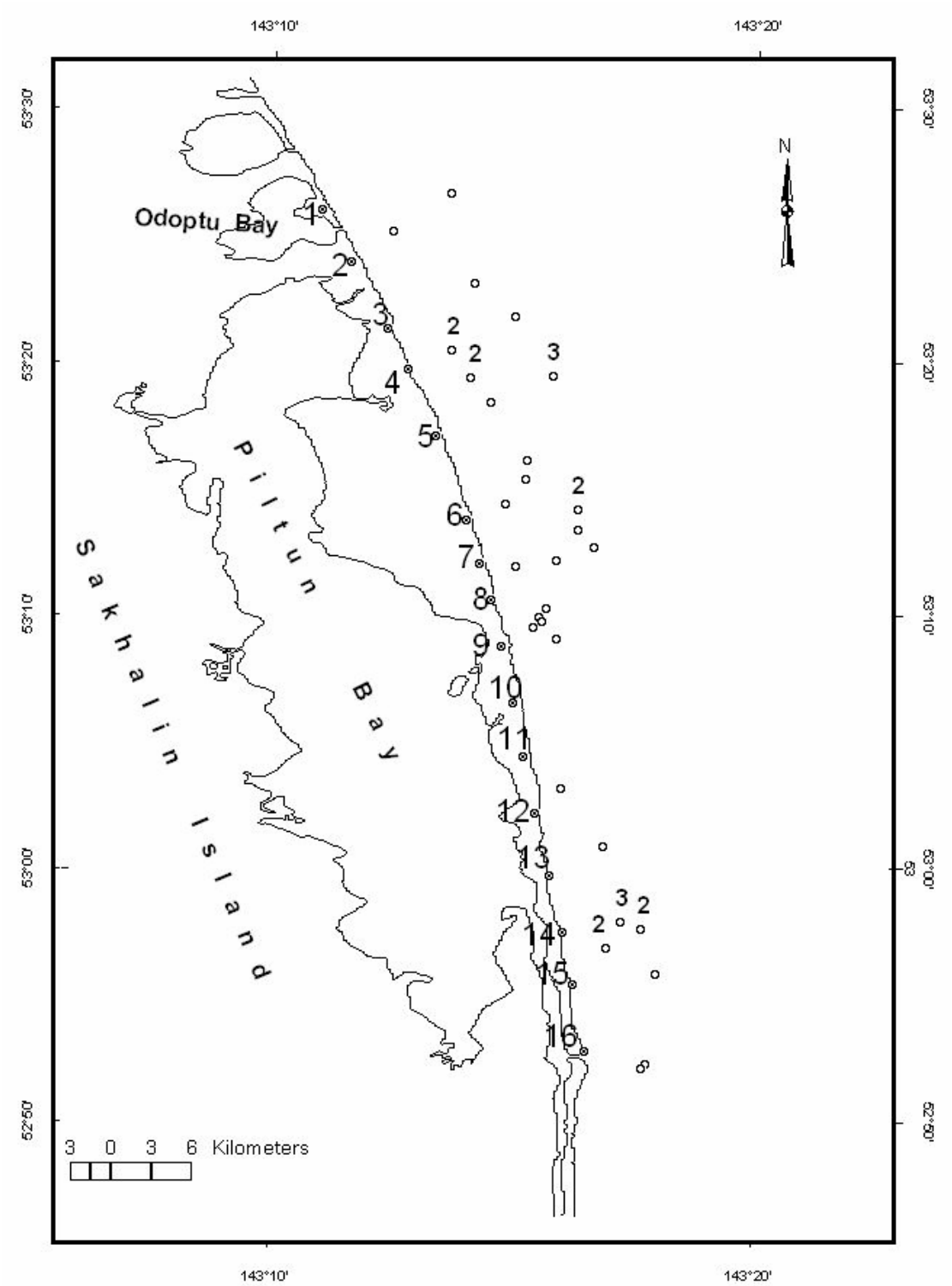


Figure 21. Results of 4 October 2003 Gray Whale Survey. Designations same as in Figure 11.

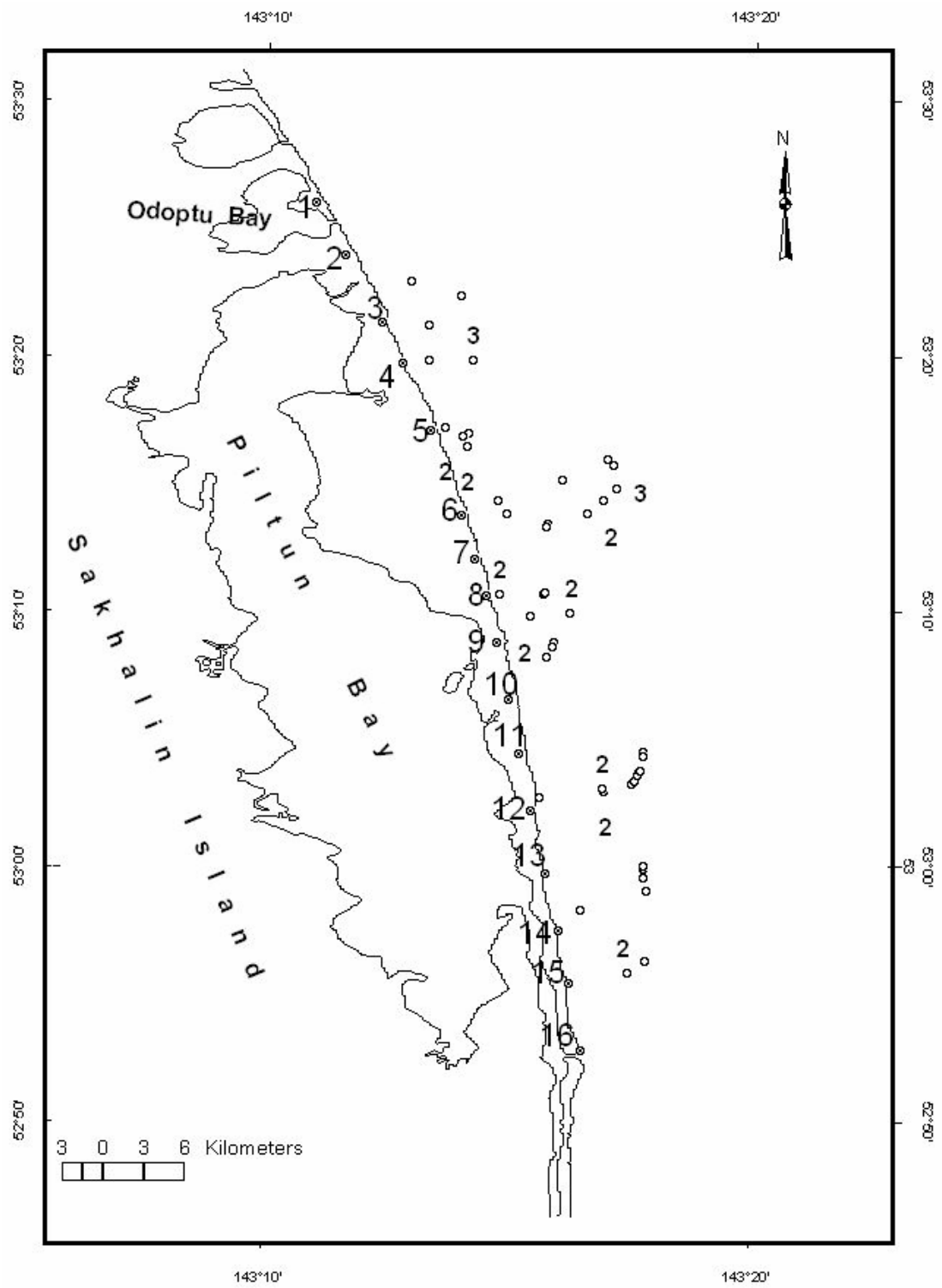


Figure 22. Results of 5 October 2003 Gray Whale Survey. Designations same as in Figure 11.

Table 6. Whale Counts along Extended Routes in October 2003.

Date	Gray whales counted
10/04/03	36
10/05/03	60
10/10/03	49
10/13/03	51
On average	49

During the first 10 days of October the whales were quite uniformly dispersed in the central and northern parts of the survey area. It is noteworthy that almost no whales were spotted near the mouth of the Piltun Bay, where up to 20 whales had normally congregated in September. There were almost no whales seen in the Odoptu Bay area either.

During the second 10 days of October there was a slight decrease in the number of animals counted. On 10 and 13 October, 49 and 51 gray whales, respectively, were counted (Figure 23, Figure 24). Again, as in September, a gathering of gray whales appeared in the northern part of the survey area. In comparison with September and especially August, there was a small number of whales scattered about in the central and southern parts of the survey area.

Throughout the entire survey period, the number of recorded whales in the survey area remained relatively constant (Table 6). The studies performed revealed the unexpectedly high precision of the onshore route surveys. During the season we counted, on average, 56.6 whales with a standard error of 2.6 individuals (Table 7). Among those surveys performed only 1-2 days apart, there was one case when the same number of whales was counted both times – 63. In three cases, the difference between surveys performed on consecutive dates was 1-4 whales.

Table 7. Statistics for Gray Whale Surveys Performed throughout the Entire Survey Area during Good Visibility Conditions.

Month	Number of surveys	Mean	Stand. error	Stand. dev.	Min	Max
August	5	57.2	4.7	10.5	42	68
September	5	62.0	2.5	5.6	55	70
October	4	49.00	4.0	9.9	36	60
For the season	14	56.6	2.6	9.8	36	70

While the number of whales throughout the entire survey area was stable, in certain parts of the survey area the abundance varied significantly (Table 8). Thus, during five surveys in August in the southern part (stations 14, 16, 16) of the survey area adjacent to the mouth of Piltun Bay, we recorded 29.2 whales on average. During five surveys in September the average number of whales counted here dropped to 17.4. In October the number of whales here was minimal. During four surveys we recorded only 7.5 gray whales mean per survey. The differences between mean number of whales per survey counted in August, September, and October proved to be statistically significant (P=0.01; P=0.004).

The mean number of gray whales counted during one survey in the central part of the survey area (stations 7, 8, 9, 10, 11, 12, 13) throughout the entire survey period remained constant (Table 8). No statistically reliable differences between the resulting numbers were found.

In the northern part of the survey area (stations 1, 2. 3, 4, 5, 6) the mean number of whales counted per survey in September was 25.47 compared to 11.64 in August, that is more than two times higher (Table 8). At the same time, the difference between the average number of whales counted per survey in August and in September proved to be statistically significant and very high (P=0.0004). During surveys in October the average number of whales counted in the northern part of the survey area was again higher – 27.33 compared to 25.47 in September; however, this increase proved not to be statistically significant (P=0.67).

Table 8. Statistical Analysis of the Results of Gray Whale Surveys in Various Parts of the Survey Area.

	Month	Quantity	Mean per survey	Std. error	Min	Max
Northern part of the survey area	August	11	11.64	6.04	4	24
	September	15	25.47	9.77	12	45
	October	6	27.33	7.15	18	37
Central part of the survey area	August	5	13.8	2.85	7	22
	September	5	16.4	5.29	5	33
	October	4	14.0	5.9	6	31
Southern part of the survey area	August	5	29.2	3.18	21	36
	September	5	17.4	1.8	12	23
	October	4	7.5	1.44	4	11

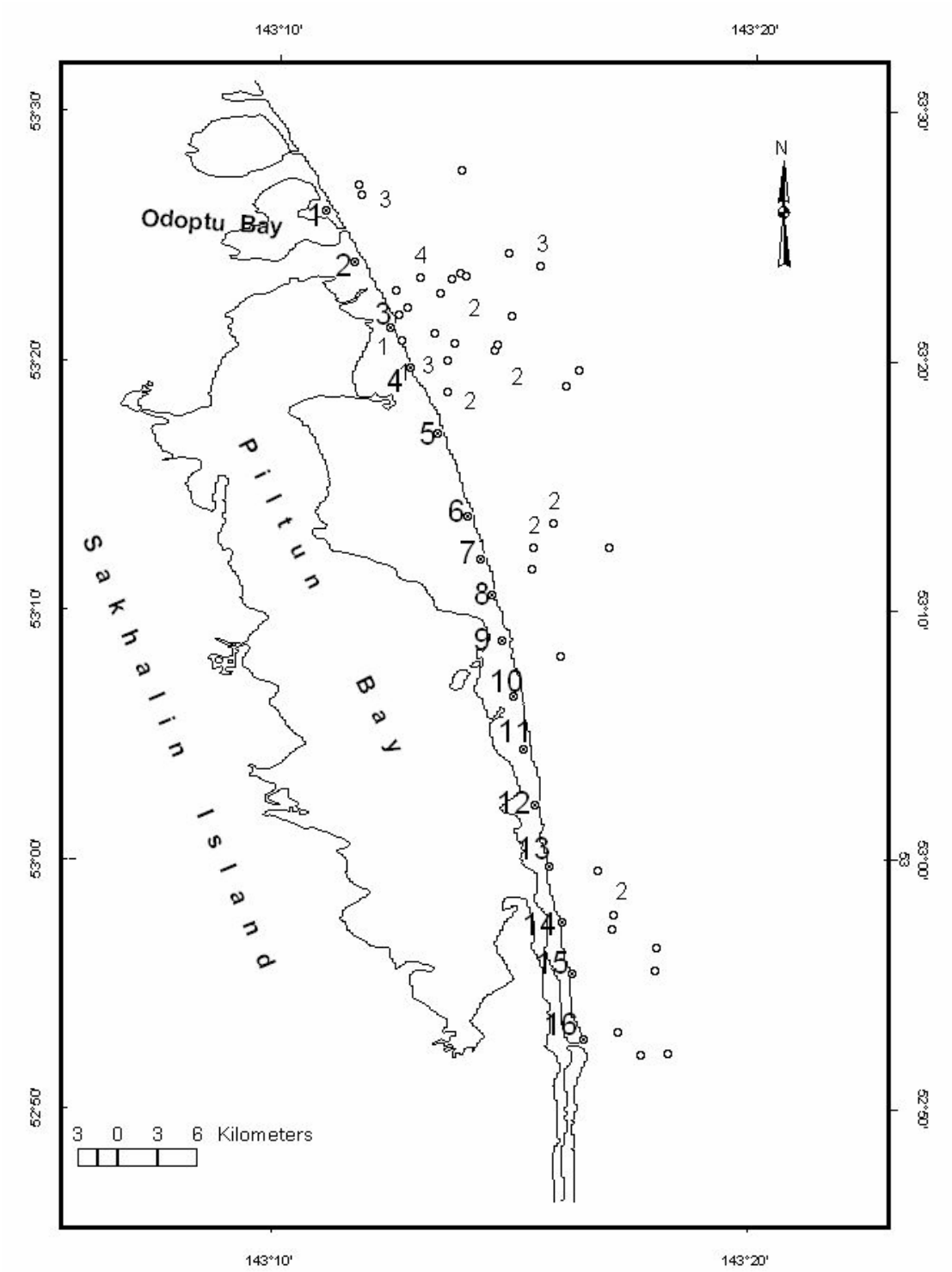


Figure 23. Results of 10 October 2003 Gray Whale Survey. Designations same as in Figure 11.

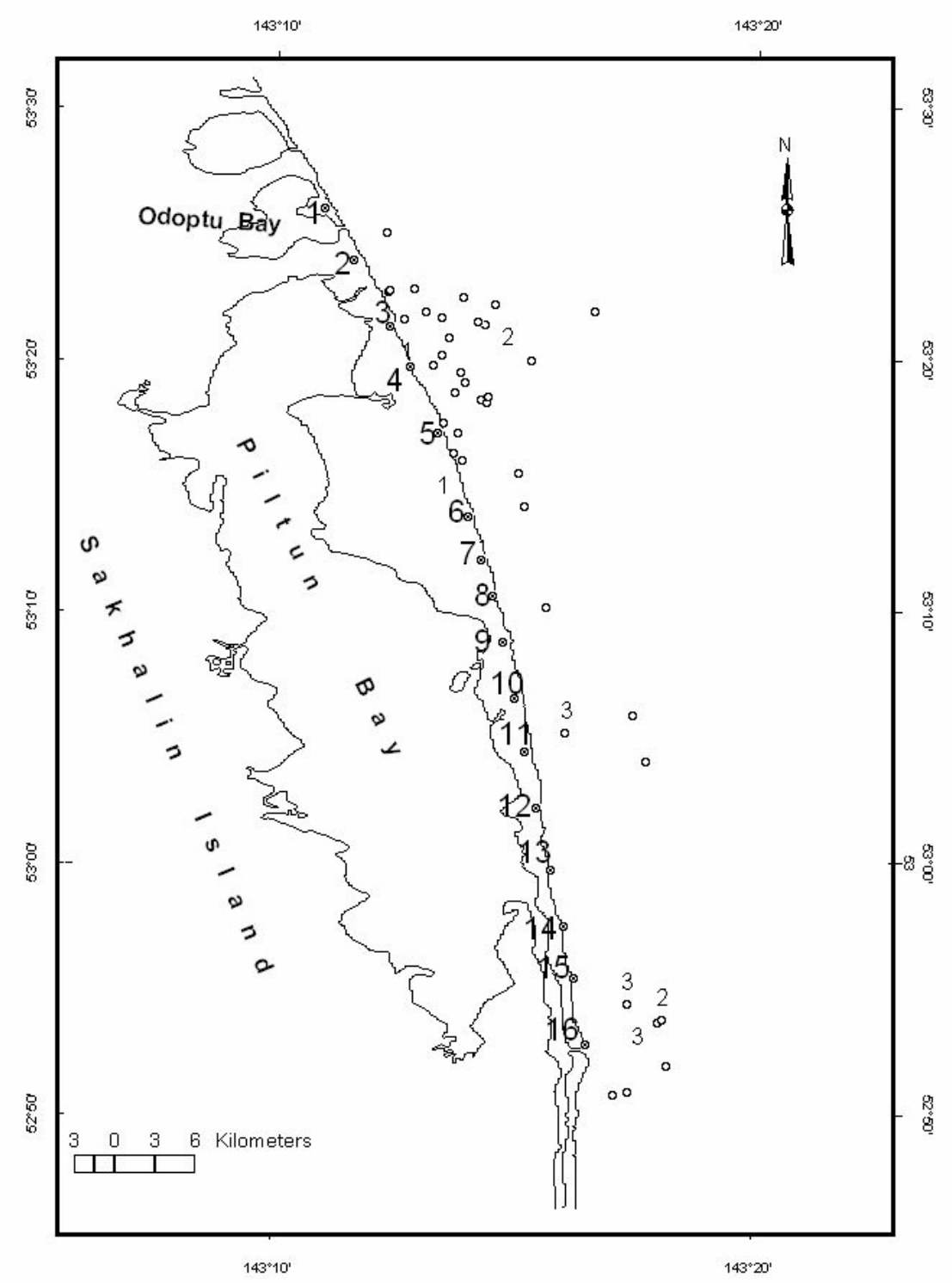


Figure 24. Results of 13 October 2003 Gray Whale Survey. Designations same as in Figure 11.

Thus, while the number of whales throughout the entire survey area remained relatively stable, in various parts of the survey area there were significant and diametrically opposed fluctuations. If between August and October in the southern part of the survey area there was a steady and substantial decrease in the number of whales, then in the northern part of the survey area the number of whales, to the contrary, increased, especially in September. One may presume that from August to October 2003 the gray whales were migrating from near the mouth of the Piltun Bay to an area south of Odoptu Bay. Along with this general migration of whales that began in late August, groupings (congregations) of whales appeared at the same time on the border between the central and northern parts of the survey area. Throughout September and into October these groupings were observed to migrate slowly and in a coordinated fashion along the shore of the Piltun Bar, from the central part of the survey area northward to the Odoptu Bay channel and back again.

In scientific literature about the gray whales of NE Sakhalin, we did not find reports of any sightings of groupings (congregations) or their migrations along the coast. However, gatherings of 30-40, sometimes as high as 100-400, gray whales are not unusual for the Chukotka-California population during their feeding along the Chukotka coast. Such gatherings last from 1 to 4 days (Tomilin, 1937; Zimushko, Bogoslovskaya et al., 1981; Yablokov). However, no coordinated migration of these gray whale groupings along the Chukotka coast had previously been observed.

The Okhotsk-Korean population of gray whales is seen as an extremely small population (Blokhin et al., 1985; Berzin et al., 1986; 1988; Weller et al., 1999; 2002; Blokhin et al., 2002). In Russian literature there are two estimates of the abundance of the Okhotsk-Korean gray whales population. One estimate, 250 whales, was made by V.L. Vladimirov (1994) based on an expert assessment of whale encounters during the period 1984-1992 in the Sea of Okhotsk. These data were obtained during different seasons using various methods and various data collection strategies, and the author does not explain how this number was obtained. The greatest number of whales spotted in September 1989 from a helicopter was 34 individuals (Berzin et al.,1990). The other estimate, 100 whales, was made by S.A. Blokhin (1996) and was based on eight surveys from the shore and one survey from a lighthouse, performed in July and August 1995 off NE Sakhalin. Later it was concluded that the number of whales off NE Sakhalin does not exceed 70-80, however the total estimate of the number of the Okhotsk-Korean population remained at the same level – 100 whales (Blokhin and Burdin, 2001). The greatest number of whales counted was 42, but these authors also do not explain

how this number of 100 was obtained. Therefore, both estimates of the abundance of the Okhotsk-Korean gray whale population mentioned above should be viewed as unreliable.

Recent 1994-1999 studies based on photo identification data put the total abundance at 88 gray whales (Weller et al., 2002). However, 1997-2000 photo identification data from 206 boat trips out to sea identified 106 gray whales, and some of the whales were seen only once (Burdin et al., 2002). Gray whales were shown to have a high rate of annual return to the same exact location for summer feeding, and the authors believe that most of the whale population was identified between 1994 and 1997. Disregarding the somewhat conflicting information, this data seems more reliable. However, in this case the authors reasoned that all the gray whales of the Okhotsk-Korean population feed off NE Sakhalin. There is no consideration of the fact that some of the gray whales may head off to feed in other feeding areas – a fact which has been reported more than once before (Berzin et al., 1990, 1991) – areas to which the same animals that visit NE Sakhalin may come.

The numbers we obtained from our direct whale counts are very close to the estimates made earlier (Blokhin et al. 2002; Weller et al., 2002). It is important to bear in mind that our survey accounted for only those whales that were located in the Odoptu-Piltun area off NE Sakhalin, and that the number of whales which, during the surveys, could have been located either to the south or north of the study area is not known. According to data by M.K. Maminov and Yu. M. Yakovlev (2002), 83 gray whales alone were counted during daylight hours on 17 September 2001 in the Offshore feeding area abreast of Chayvo and Nyisky bays.

Distribution and Abundance of Gray Whales in the Northern Part of the Survey Area

A particular, project-specific objective of the onshore route surveys in 2003 was to study the distribution, abundance dynamics, and behavior of gray whales in the area between stations 1 through 6 to determine the optimal location and timing for the planned barge dock construction area. The key issue here was to determine if any locations consistently had low whale density over significant periods of time. Data from the behavioral studies provided some data on the densities of whales further south. Therefore, during the survey work, a lot of attention was devoted to gray whale surveys in the area between 53°23’ and 53°13’ N. lat., i.e. surveys along the short routes in the northern part of the survey ar**ea (**Figure **1).**

Poor weather conditions limited work during July to two uncompleted surveys. Under poor visibility and strong wind conditions on 24 July, five gray whales were counted; on 28

July – three gray whales. Looking back now, one can state nothing more than that there were gray whales present in July in the northern part of the survey area.

During the first 10 days of August the whale survey again proved very unfavorable. From 13 through 25 August the abundance of gray whales in the northern part of the survey area remained fairly stable and relatively low (Figure 25). During this time single whales and small groups of up to four whales fed here. In the northern part (Odoptu Bay area), where the barge dock construction is planned, except for a female and her calf that passed through on 14 August and whales heading south on 14-15 August, almost no other gray whales were observed.

The number of whales in the northern part of the survey area was noted to increase on 26 and 28 August. In addition, on 26 August the whales were quite scattered about in the vicinity of observation stations 5 – 6, then on 28 August they had grouped together close to shore near observation stations 4 – 5. Whales were also seen in the most northern area near observation stations 1 and 2 (Figure 25 g, h).

In September there was a continuation of the trend noted in late August for the number of whales in the northern part of the survey area to increase. Isolated groupings of gray whales began to approach, as noted above. Thus, on 2 September a grouping of about 20 whales was seen at observation station 6 (Figure 26 a), then on 3-4 September they were spotted at observation stations 5, 4, and 3, and on 5 September they had appeared at observation stations 2 and 3 (Figure 26 a,b,c). This same migration, only in a southerly direction, was tracked 10-13 September. Sometimes a portion of the whales would break away, and the number of counted whales would drop. However, overall throughout all of September, there was a noticeable increase in the number of gray whales in the northern part of the survey area.

In October, as compared with September, the number of gray whales in the northern part of the survey area had dropped a little; nonetheless, the number of whales counted here remained relatively high and stable (Figure 27 a, b, c, d).

We paid a lot of attention to the potential locations of the temporary barge quay that is planned for Sakhalin 1, which is to be built in the Odoptu Bay area between observation stations 1 and 2. In August the number of whales in the immediate vicinity of the planned dock construction was relatively small, the smallest during the whole survey season (Figure 25). In September their average number at the time of the survey had noticeably increased (Figure 26), and in October the number fell off a bit (Figure 27).

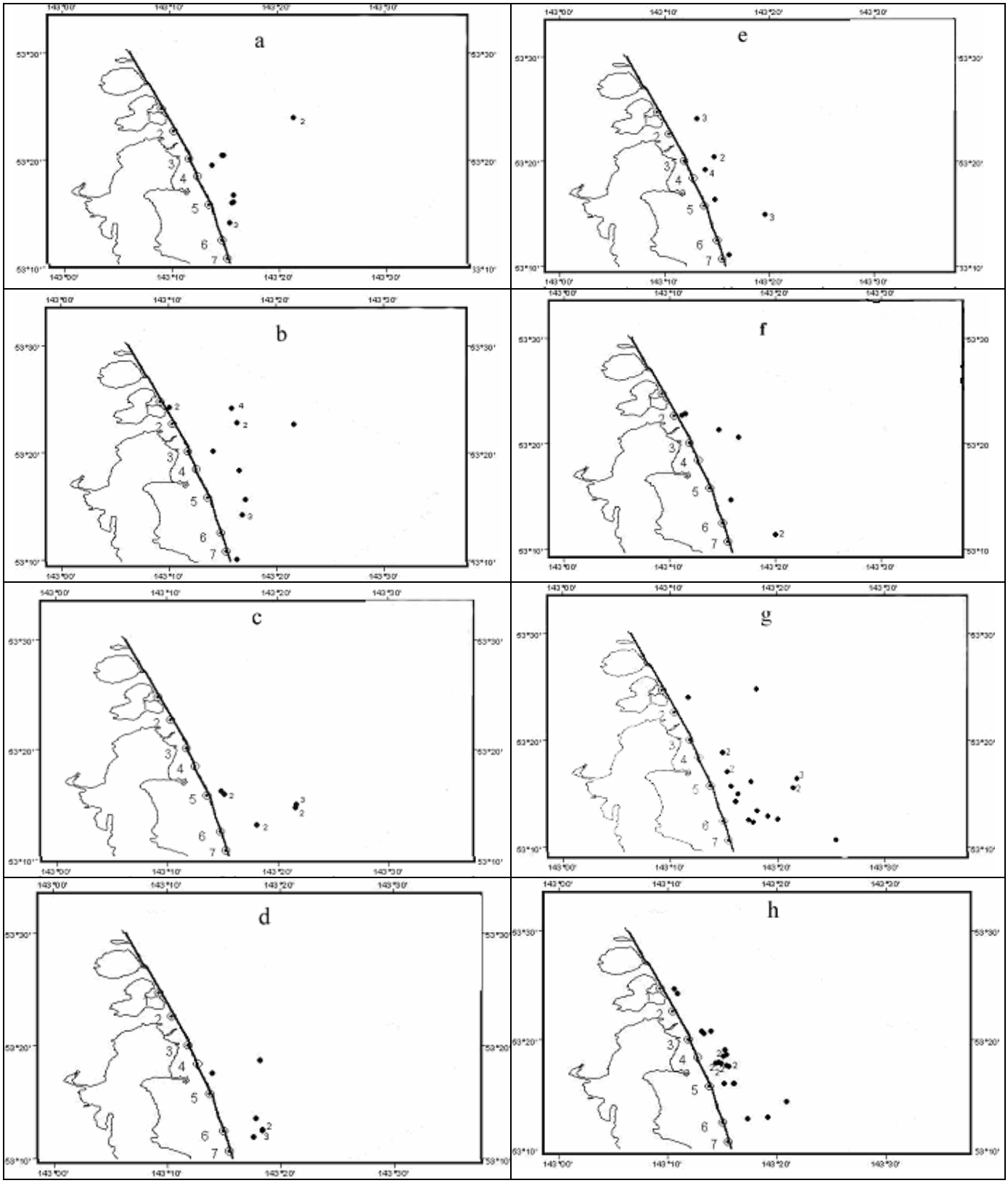


Figure 25. Distribution of Gray Whales in the Northern Part of the Survey Area in August 2003. a - distribution of whales on 13 August; b - distribution of whales on 14 August; c - distribution of whales on 18 August; d - distribution of whales on 19 August; e - distribution of whales on 20 August; f - distribution of whales on 23 August, g distribution of whales on 26 August; h- distribution of whales on 28 August. The observation stations are marked by a circle with a dot; numerals indicate the observation station number. Single whales are indicated by a dot; numerals indicate the number of whales in groups.

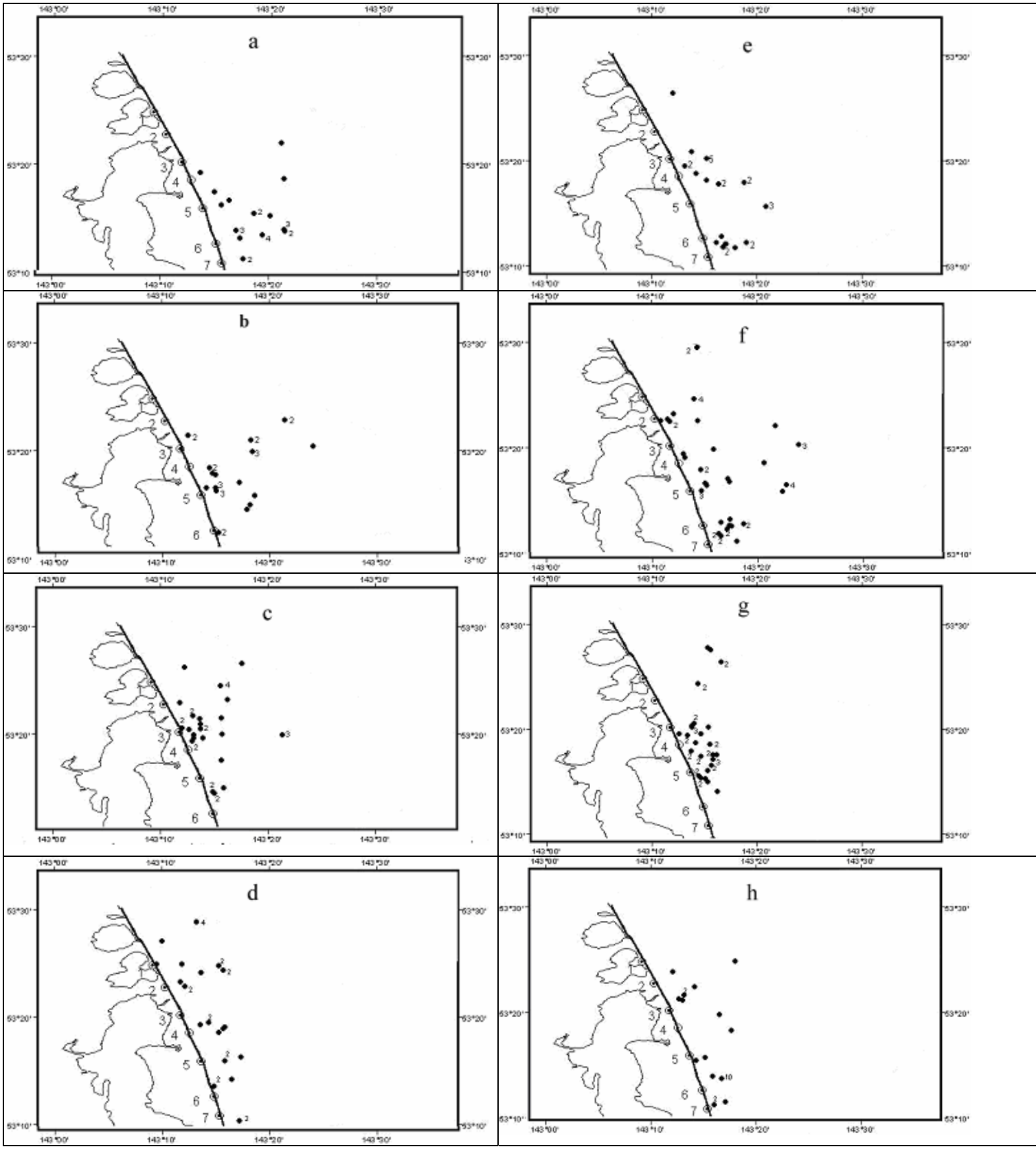


Figure 26. Distribution of Gray Whales in the Northern Part of the Survey Area in September 2003. a – 2 September; b – 4 September; c – 5 September; d – 10 September; e – 13 September; f – 21 September; g – 24 September; h – 27 September. Designations same as in Figure 25.

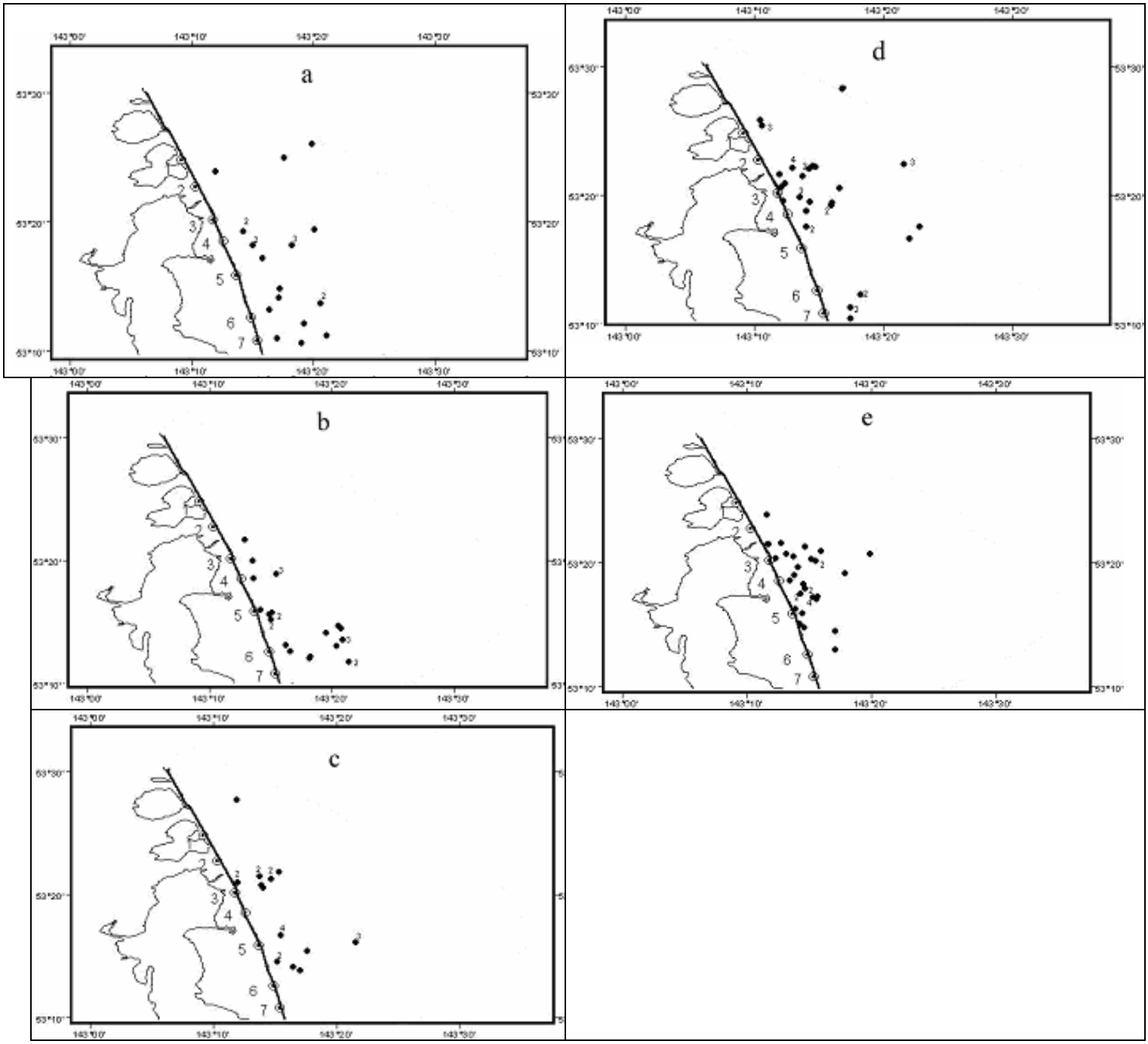


Figure 27. Distribution of Gray Whales in the Northern Part of the Survey Area in October 2003. a- 4 October b – 5 October; c- 7 October; d – 10 October; e – 13 October. Designations the same as in Figure 25.

The data collected in 2003 show the relatively rare presence of whales in the survey sector near location 1, especially north of it, where we seldom found whales. In this regard one might suggest that the site of the planned dock construction be moved as far north as feasible and placed a bit south of the Odoptu Bay channel. This location is where the whales appear most seldom, and the seafloor and shore have structure similar to the planned location, 53 ^{o} 23'N. lat.

Nature of Gray Whale Behavior during the Survey Period.

Social Behavior

During the survey period the gray whales rarely demonstrated playful behavior. Only occasionally did we see tail smacks, displays of pectoral fins, etc. Mostly the ones playing were calves next to their mother. The playful behavior of the adult whales was expressed as head displays, waving their tail fins, and poking their pectoral fins out of the water.

In early September groups of whales appeared with clear signs of unusual social behavior. These groups consisted of congregations of 20 – 30 animals slowly moving north along the coast line. Within these congregations there were groups of 3-4 whales that stayed a bit apart and farther from the shore than the other animals in the congregation (Figure 28). The whales in these isolated groups behaved very actively – the animals would emerge on the surface close together, almost at the same time, would display their pectoral fins and tail fans above the sea surface, would spin around their longitudinal axis, would jerk their heads, and would make white-caps after exhaling under water. The whales would shove each other demonstratively, and would hit one another from below in the pelvic area. Overall the animals' behavior in these groups was very reminiscent of the gray whale behavior previously observed during the autumn in the waters off Chukotka Peninsula, within which there was a pronounced prevalence of signs of mating (Tomilin, 1937; Bogoslovskaya et al., 1981; Ljungblad et al., 1987). These groups with the clearly pronounced signs of mating behavior stayed together for several days, moving slowly along the coast. Not far from them, there were always single whales, pairs and small groups of other whales demonstrating customary behavior. One could sense that these groups with the reproduction-focused behavior were the nuclei of these congregations, despite the fact that they were somewhat physically isolated from the rest. The first such group was sighted on 4 September, and the last on 9 October (Table 9). The vast majority of them were seen in the northern part of the survey area, and only one was recorded at the mouth of the Piltun Bay channel.

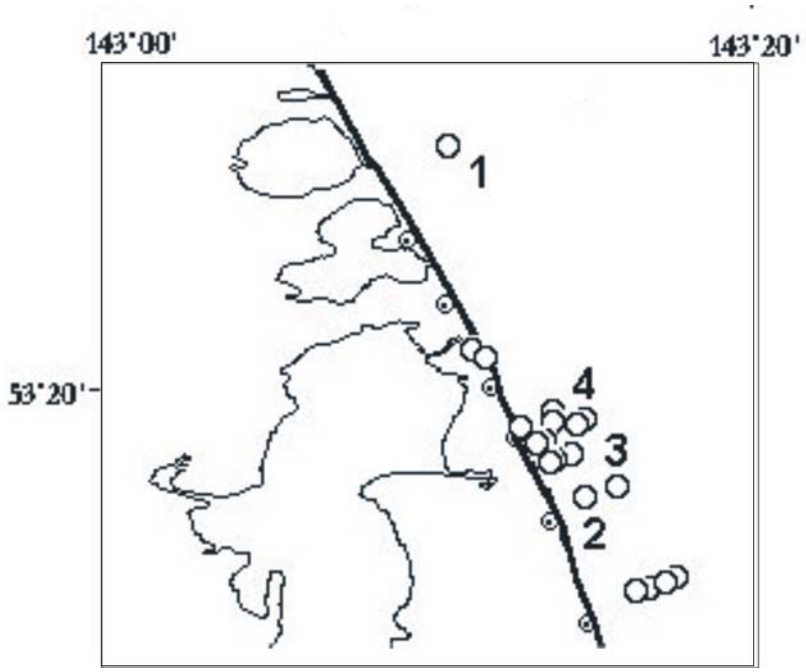


Figure 28. Distribution of Gray Whales in the Northern Part of the Survey Area on October 9, 2003. Symbols represent single whales, numerals represent the number of whales in groups. A congregation including the group of 4 whales with a pronounced prevalence of signs of mating behavior was seen.

Table 9. Encounters of Groups of Whales with Signs of Mating Behavior during the Onshore Surveys in 2003.

Date	Number of whales in the group	Observation station №
09/04/03	3	3
09/05/03	4	2
09/05/03	3	3
09/13/03	5	3
09/13/03	4	6
09/21/03	4	4
09/23/03	4	16
09/23/03	3	6
10/04/03	3	5
10/05/03	3	5
10/09/03	4	3

We spotted the first group to exhibit typical signs of mating behavior on 4 September. It is quite possible that we did not notice the unusual behavior of these groups right away, and that the congregations we saw in late August were also associated with these groups. We spotted the last group to exhibit signs of mating behavior on 9 October. The vast majority of these groups were in the northern part of the survey area, and only one group was near the mouth of Piltun Bay.

Regardless of the results of these observations, it is still too early to say that the gray whales are propagating in Sakhalin waters in September and October, since so far no direct instances of animal mating have actually been documented. We could not do this due to these groups' distance from shore and the impossibility of seeing this at a distance of several kilometers using standard binoculars. Because of this, it is essential that special studies be organized and conducted in the near future in order to examine in detail this phenomenon, which is extremely important in understanding the biology of the Okhotsk-Korean population of gray whales.

Only 11 sexually mature, reproducing female gray whales were recorded off NE Sakhalin between 1995 and 1999 (Weller et al., 2002). Considering the fact that the calf - bearing period for Okhotsk-Korean gray whale females is three years (Brownell, Weller, 2002), there may currently be about 20 breeding females in the Okhotsk-Korean population.

Feeding Behavior

Feeding behavior of adult animals. Trying to build up sufficient reserves for the upcoming winter, gray whales feed almost constantly in their feeding areas. The feeding behavior of adult animals off NE Sakhalin is noticeable, first and foremost, for how the feeding animals form groups within very limited areas. Feeding in an apparently small feeding spot, the whales took turns coming to the surface in the very same location, creating a spectacle reminiscent of a "carousel". Some of the animals were on the surface, others were under water. Then, after a small pause, the next animals would come to the surface, and the previous ones would go under water. Only with a sufficiently prolonged observation period were we able to clarify that not just one gray whale seen at the surface was feeding in a very small area, but two, and sometimes even three whales. In certain instances up to 10 whales were gathered in such "feeding" areas.

During ebb tide at the mouth of Piltun Bay, gray whales sometimes would form large groups of 3 – 6 animals on the seaward side of the sand banks, where, thanks to the effect of

the ebb current, food is apparently concentrated. During high tides, if there was no wave run-up, the gray whales alone or in groups of two would head away from shore and spread quite far apart.

In August, when waves were striking the shore at an oblique angle, the gray whales fed directly among sand bars in the channels and basins between the sand banks, where it seems the wave run-up apparently dumps benthos. Sometimes during this "oblique" wave run-up action, in certain areas, especially in the southern part of the Piltun Bar, large whales in groups of up to six would feed right there in the surf zone 100-300 m from shore. In such a group even mothers and their babies could be seen among the adults and large animals.

In September and October, when wave action was parallel to the shore, the gray whales, alone or in pairs, would spread out like a chain, one behind another, along the outer boundary of the shoal, which was easily distinguishable by the mud turbidity the waves had stirred up. Apparently, in this situation, the wave action creates local concentrations of food, which the whales take advantage of.

Feeding behavior of whale cows with calves and calves. Females with calves were seen most often in August. These animal pairs preferred to stay isolated and the females tried to lead their nursing young along the littoral shelf. On 13 August, as the wave run-up action weakened and the greatest number of these pairs was recorded, one could see that most of them were in the shallow waters of the surf zone, between the outer and inner bars. In this area, where the energy of the wave run-up has been significantly extinguished by the outer bar, it is relatively calm. Here, apparently, in a system of basins and channels, there is a physical concentration of food items. An examination of the items dumped here revealed a genuine "food clump" made up of algae, in which benthos organisms had become entangled by the action of the surf (**Figure** 29).

During the survey period in this area, 83% of the recorded cow-calf pairs (Figure 30, Figure 31) were seen among the sand bars less than 1 km from shore. Calves who had recently begun feeding on their own also preferred to be among the sand bars, especially during times of weak wave run-up action, and at these times an adult whale, presumably a female, could sometimes be seen on the outer side of the sand bank.

The transition to an independent lifestyle is a critical period in the life of any animal. Among the sand bars off the NE Sakhalin coast, calf gray whales learn to search for food, practice capturing the food they need, and get the chance to begin their independent life.

Therefore, the littoral shelf off NE Sakhalin is very important to the survival of the offspring of the Okhotsk-Korean population of gray whales.

Reaction of gray whales to anthropogenic impact. In light of the industrial development of the NE Sakhalin shelf, one of the primary factors affecting the whales are the noises from human activity. Boat traffic is the most popular type of human activity at sea. As a large boat approaches, gray whales usually try to get away from its path of motion. If they are unable to do this, a gray whale will sometimes dive down for a long period of time and wait under water for the boat to pass. On 23 August we witnessed a typical example of a gray whale's reaction to the movement of a boat. A seine-net fishing vessel was traveling along the shore from the north. As the vessel drew near, a feeding gray whale began to react to the vessel, some 700-900 m away. At first the whale headed south in the direction the vessel was traveling, moving closer to shore. Six subsequent immersions every 15-30 seconds were sighted, then the whale dived down for a long time and came up again only after the vessel had passed.

Figure 29. Benthos Organisms Dumped by the Surf on the NE Sakhalin Shore.

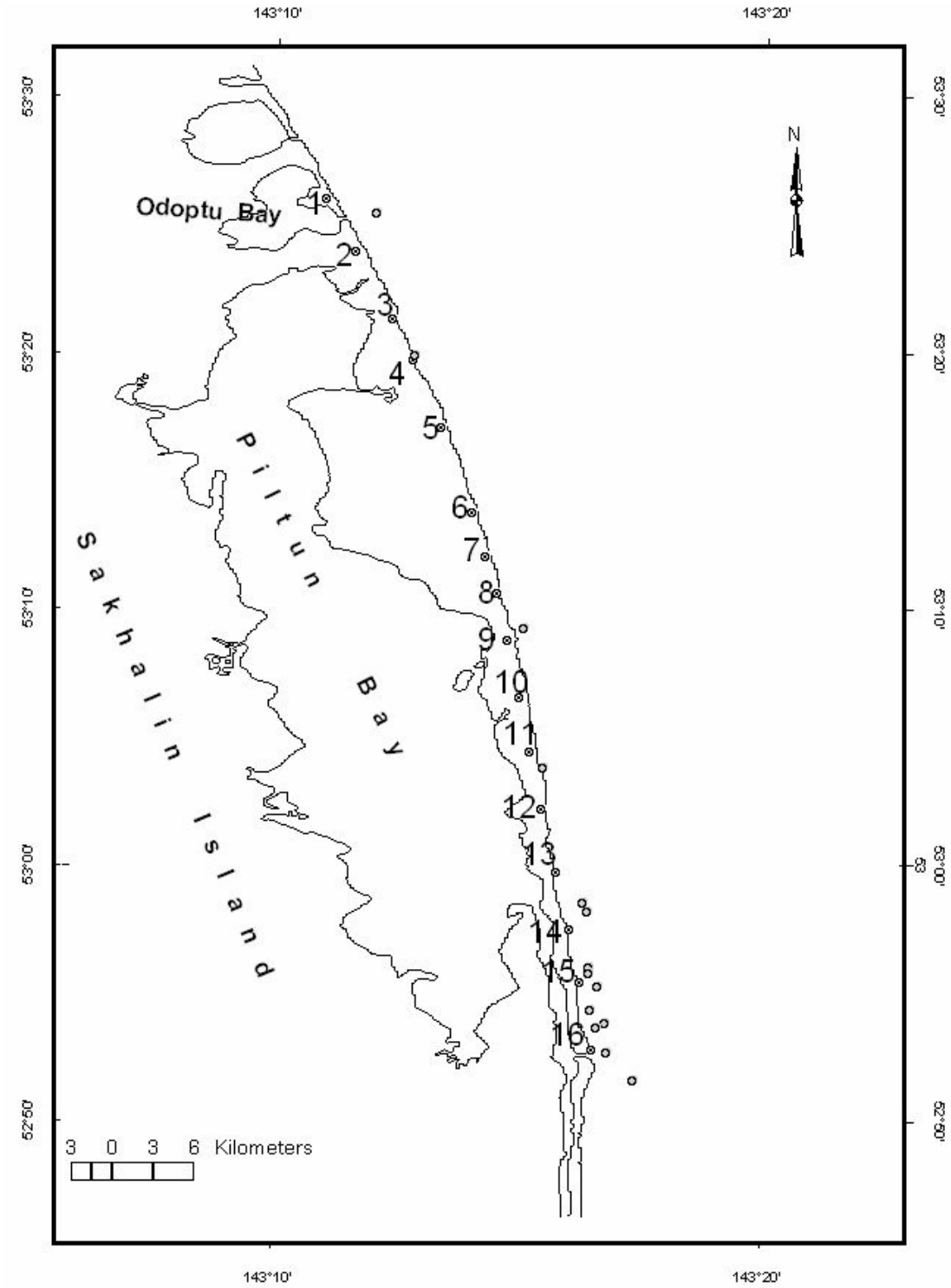


Figure 30. Distribution of cow-calf pairs and underyearlings in the Odoptu-Piltun area in August 2003. The locations of cow-calf pares and calves sighting are indicated by circles. Other designations same as in Figure 11.

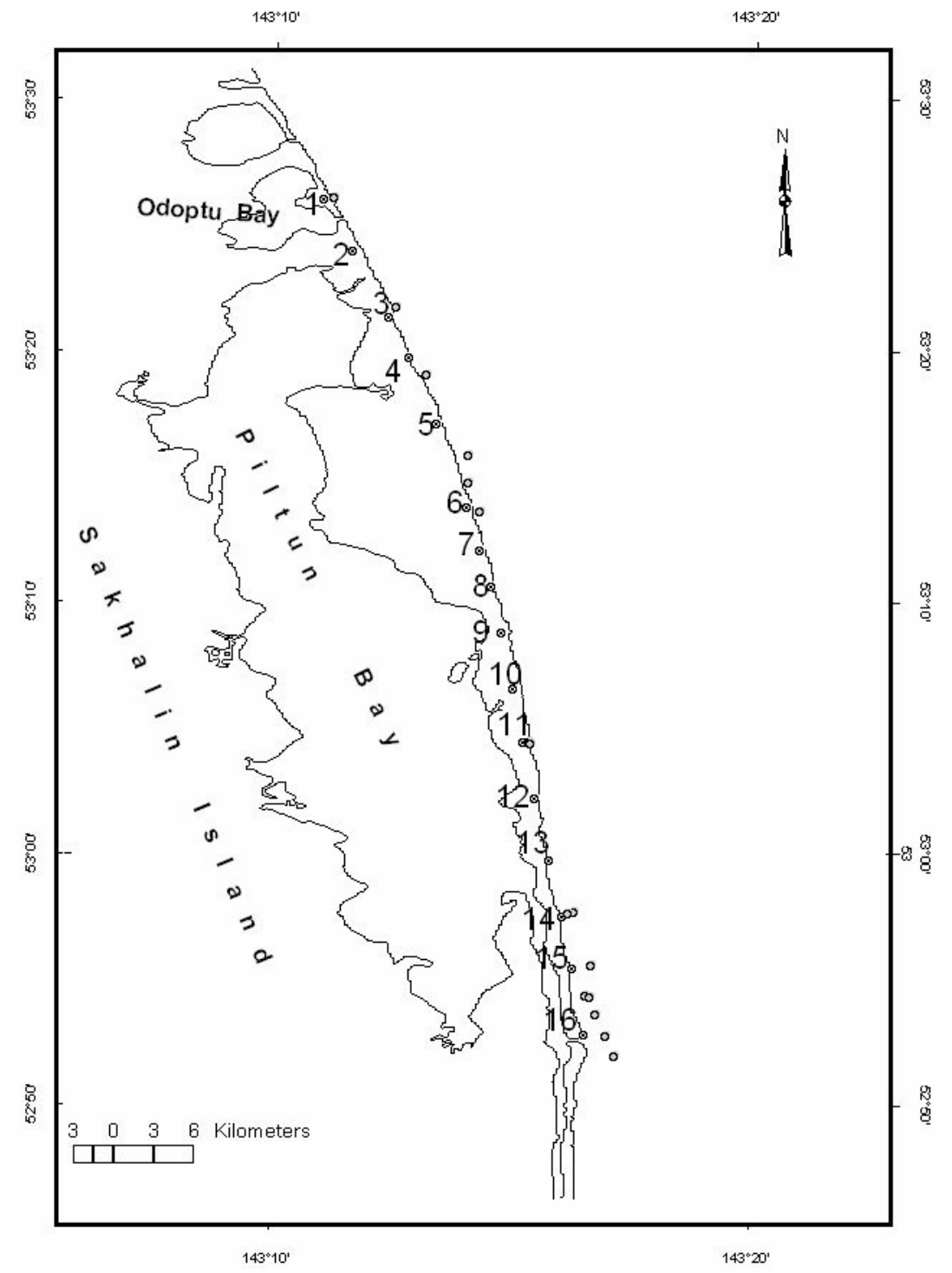


Figure 31. Distribution of female -calf pairs and underyearlings in the Odoptu-Piltun area in September 2003. Designations same as in Figure 30.

When a passing motor boat approached, the gray whales reacted much the same as to the fishing vessel. The whales reacted differently, however, when they were followed in boats. For example, on 25 August, when the "Zodiac" carrying a group led by Yu. Yakovlev approached a group of six whales that had been feeding for several days near observation station 3, the whales began to swim seaward, away from the boat, in pairs. The whales were obviously avoiding the motor boat. Later, when two gray whales were unable to lose their trackers, one of them did a high leap in front of the "Zodiac". After this incident it was several days before the gray whales returned to their previous location.

The gray whales had a similar reaction when, on 7 September, they were tracked by the "Zodiac" led by D. Weller. As the boat tried to approach a group of feeding whales, a gray whale again did leaps, just like before, although, in our opinion, overall the whales reacted more calmly to the "Zodiac" this time. This gave the impression that a leap from the water is the whales' reaction to being followed and is perhaps an act of intimidation. A leap and a loud smack of an enormous body against the water will make an impression on anybody.

After the boats departed, the whales always hid. When they emerged on the surface, they tried not to spout, displaying only their blowhole, and they stayed under water for long periods of time; even during times of very good visibility it was hard to see any of the whales. Only after 30-45 minutes would they begin to behave normally.

After a helicopter passed over the whales at an altitude of 200-250 m, such as occurred on 5 October, the whales had a similar reaction. The whales hid, almost stopped spouting entirely, and spent longer periods under water. Only after 30 minutes did the whales begin to behave normally again.

In contrast to the helicopter, after an airplane with a scientific group on board had flown over them at an altitude of 300-400 m, the whales did not demonstrate any noticeable behavioral change.

Presently, scientific activity to investigate gray whales using motor boats, vessels, and airplanes is the only way to study whales in this area. At the same time, this activity is the main factor that disturbs gray whales off NE Sakhalin.. The observations described above point to gray whales' acutely negative reaction to being approached, and especially followed, by research vessels and boats. Bursk (1989) reported a similar change in gray whales' behavior, direction, and speed of motion when the Chukotka-California population of gray whales was in the presence of boats. When boats appear, gray whales migrating along the coast of North

America try to stay under water for a long time and come up to the surface only to breathe (Hubbs and Hubbs, 1967). The fact that the whales have changed their migratory route to be farther from shore along southern California is seen as a reaction to the disturbance caused by motor boats (Rice and Wolman, 1971).

We did not see any gray whale reactions to collecting skin samples for biopsy. In published materials there is no description of a gray whale reaction to the taking of such samples using special arrows (Moore and Clarke, 2002). It has been reported that tagging gray whales with special tracers causes them to react by clapping their tail against the water and fleeing quickly, but soon thereafter they return to their normal behavior (Harvey and Mate, 1984 in Moore and Clarke, 2002). Nonetheless, the whales' reaction to the taking of samples for skin biopsy must be investigated, especially among such a small population of gray whales as the Okhotsk-Korean population (IWC, 2002).

Group Sizes

We took a group to mean two or more animals that, during the survey period, stayed close to one another and performed coordinated actions. Groups must be distinguished from congregations, where the number of animals is an order of magnitude larger and consists of individual groups which behave independently but make movements, usually along the coast, that are coordinated with other groups and single whales. There are certain challenges in determining the make-up of groups of gray whales at feeding times in the feeding areas. During this period, most gray whale groups are unstable and last a short time. Groups of several whales often form around a feeding spot, which other animals are drawn to. Whales begin taking turns coming to the surface, so determining the number of animals in the group requires prolonged observation. After finishing feeding, such groups of gray whales easily break apart.

In 2003 observations, 346 groups of gray whales were recorded. The number of animals in a group ranged from 2 to 10 (Table 10). In the vast majority of cases, gray whales kept to themselves (64.8%). Groups of two animals were encountered in 22.5% of the cases (n = 346) and groups consisting of three animals in 8.46% of the cases (n = 65). Groups of four animals were encountered in 3.13% of the cases (n = 24), and only 1.04% of groups (n = 8) consisted of five or more animals. The average group size in 2003 was 1.5 ± SD 0.91 (n = 768), and the median and mode were equal to one (Table 11). The greatest average group size was observed

in September - - 1.6 ± SD1.0 (n = 342), and the smallest in October – 1.4 ± SD 0.75 (n = 177) (Table 11).

The paired t-test to assess the differences in the average group size recorded in August was more statistically reliable than the average group size recorded and in September revealed that the average group size in September was more statistically reliable than the average group size recorded in August (P = 0.03). The average group size recorded in September was more statistically reliable than the average group size recorded in October (P= 0.005). At the same time, the quantitative make-up of groups recorded in August, though somewhat larger than in October, is not distinguished in terms of statistical reliability (P = 0.08). Thus, in September 2003 the number of whales in groups was more statistically reliable than the number of gray whales in groups in either August or October.

Table 10. Quantitative Make-up of Groups of Gray Whales in Feeding Areas off NE Sakhalin.

Period	Number of whales in group						
	1	2	3	4	5	6	10
August	163	58	17	6	3	1	0
September	206	85	35	13	2	1	1
October	129	30	13	5	0	0	0
Total groups	498	173	65	24	5	2	1
% of total number of groups	64.84	22.53	8.46	3.13	0.65	0.26	0.13
Total whales	498	346	195	96	25	12	10
% of total number of animals	42.12	29.27	16.5	8.12	2.12	1.02	0.85

Table 11. Statistical Analysis of Group Sizes.

Period	Number of recorded groups	Average group size	Median	Mode	Standard Deviation	Rank of groups
August	248	1.51	1	1	±0.87	1-6
September	343	1.63	1	1	±1.00	1-10
October	177	1.4	1	1	±0.75	1-4
Overall	768	1.54	1	1	±0.91	1-10

According to data from Weller et al. (1999), the average gray whale group size off NE Sakhalin is equal to 2 ± 1.8. According to the results we obtained for this reporting season, the average group size was 1.54 ± 0.91 individuals (Table 11), which is significantly lower. In our sampling the percentage of single whales – 64.8% - was significantly higher than the 43.1%

reflected in data obtained from boat-based observations from Weller et al. (1999). The results we obtained are consistent with data from Blokhin and Burdin (2001), who made surveys from shore. This discrepancy is most likely attributable to the fact that the rate of missed single whales is high when working from a boat.

Spatial Distribution of Whales Versus Distance from Shore

Table 12 and Figure 32 present the variability of gray whale distribution versus distance from shore for the entire survey area. As the table and figure clearly show, the most significant differences in gray whale distribution are between their distributions in August and in September. The differences between the average values here reach 1100 m, and the difference coefficient between whales distribution in August and September is very significant ($P<0.0001$). At the same time, differences between the whales' distribution in September and October are slight ($P=0.8$).

Table 12. Statistical Analysis of Gray Whale Distribution Relative to the Shore for the Entire Survey Area.

Month	Number of measurements (n)	Average (m)	Min	Max	Standard error
August	255	2447	48	12510	129.8
September	343	3548	96	16640	163.0
October	177	3484	312	12080	188.4

As autumn approaches, Figure 32 shows the distribution of whales in relation to their distance from shore changed significantly. If in August 79% of whales were within the first 3 km, then in September 58% of gray whales were in that same area. In October the proportion of whales found within the first 3 km was even smaller (21%), but at the same time the number of whales observed farther than 3 km from shore rose to 46.2% (Figure 32).

Thus, as autumn approaches, gray whales in the survey area move farther from shore. The most significant changes are seen between the distribution of whales in August and the distribution of whales in September.

The re-distribution of whales happened differently in various parts of the survey area. In the northern part of the survey area only 25% of whales in August and 30% in September were within 2 km from the shore (Figure 33). In October 77% of whales were within the first 2 km in this area, and only 23% of whales were farther than 2 km from shore.

In the southern part of the survey area in August and September, roughly 44% of whales were within 2 km of the shore (Figure 33). In October only 4.2% were within 2 km of the shore, and 95.8% of whales were farther than 2 km from shore.

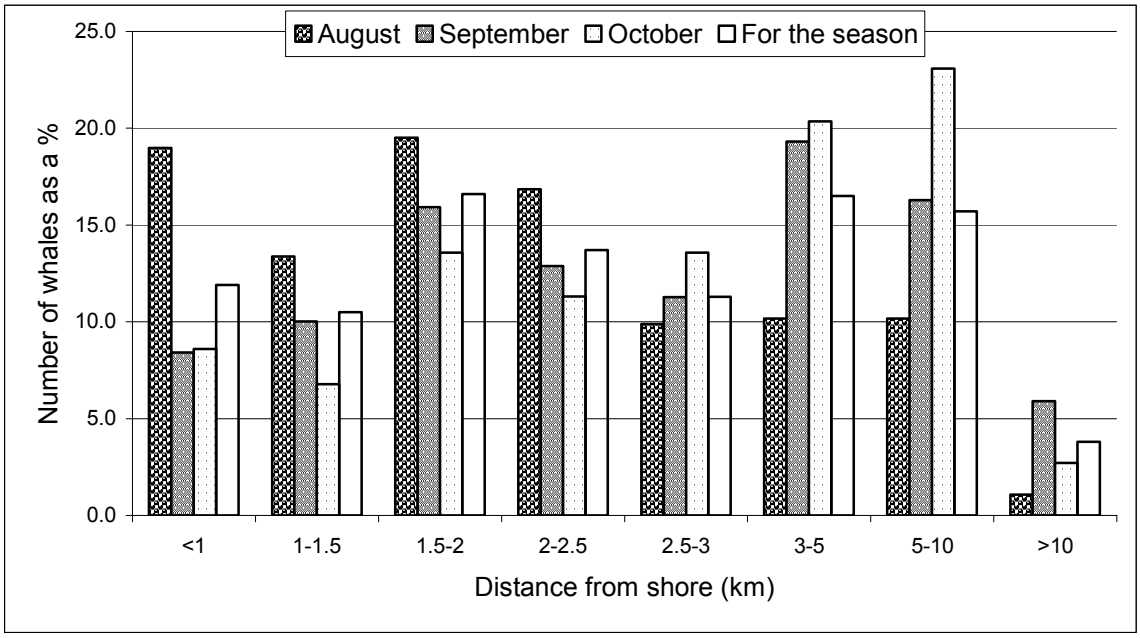


Figure 32. Frequency Distribution of Recorded Whales by Month Versus Distance from Shore for the Entire Survey Area.

In the central part of the survey area, as autumn approaches, the re-distribution of whales was transitional in nature. However, in August 30.4% of gray whales were in direct proximity to the shore (less than 1 km), while in the southern part only 9.7% and in the northern part only 2.3% of whales were that close.

In published materials there is little data on the distribution of gray whales off NE Sakhalin versus distance from shore, and those data that are given are based on visual estimates for the area near the mouth of Piltun Bay (Blokhin and Burdin, 2001; Blokhin, 2002; Weller et al., 2002). The authors also note that as autumn approaches, the whales are observed to head farther out from shore.

Number of Females with Offspring and the Dynamics of Gray Whale Calves' Transition to Independence

During the survey period 24 encounters of cow-calf pairs were recorded. Of these, 14 pairs (58%) were seen in August, 10 (42%) in September, and one pair in October (**Figure** 29, Figure 30, Table 13). The greatest number – five cow-calf pairs and one calf were observed on 13 August along the extended route at a time when wave run-up was subsiding after a storm. All mothers and calves and the calf were observed only in the southern part of the survey area between observation stations 11 and 16. Another cow-calf pair was recorded on 12 August near observation station 4, and apparently that same pair was recorded near observation station 1 on 14 August. Most likely, this was one more pair that had not been detected in the 13 September survey. In total there were six gray whale calves in the survey area 13 September. In relation to the greatest recorded number of gray whales in the survey area (70 individuals), in 2003 the offspring constituted about 9%. This indicator, both for the recorded number of calves and the percent of offspring, was higher than values previously recorded for this area (Weller et al., 1999; 2003).

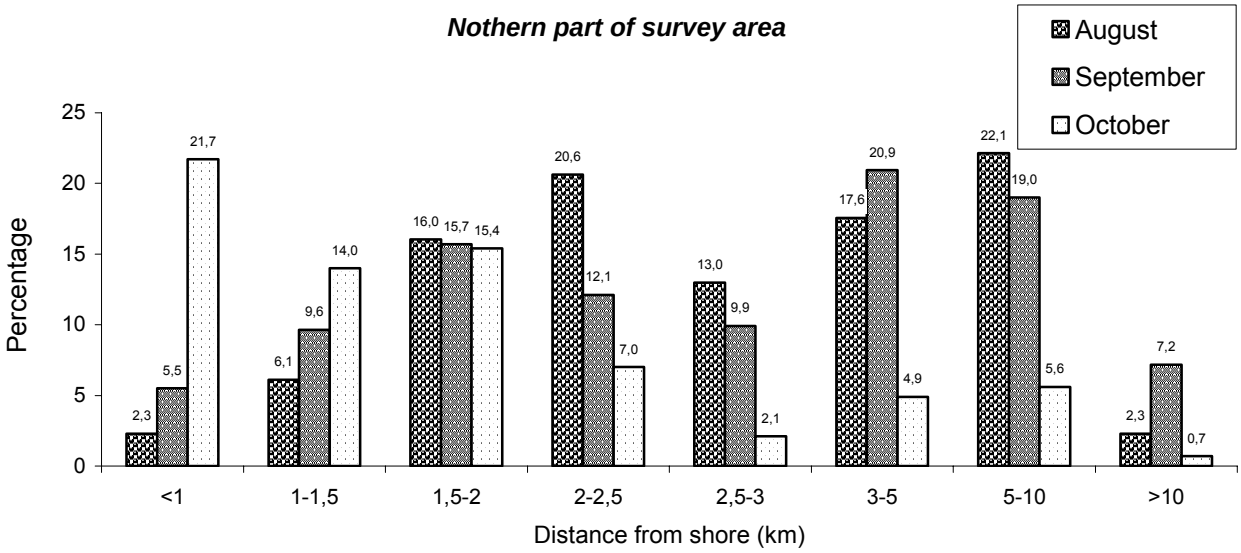
Table 13. Counts of Gray Whale "Cow-calf" Pairs and Calves along Extended Routes for the Entire Survey Area in 2003.

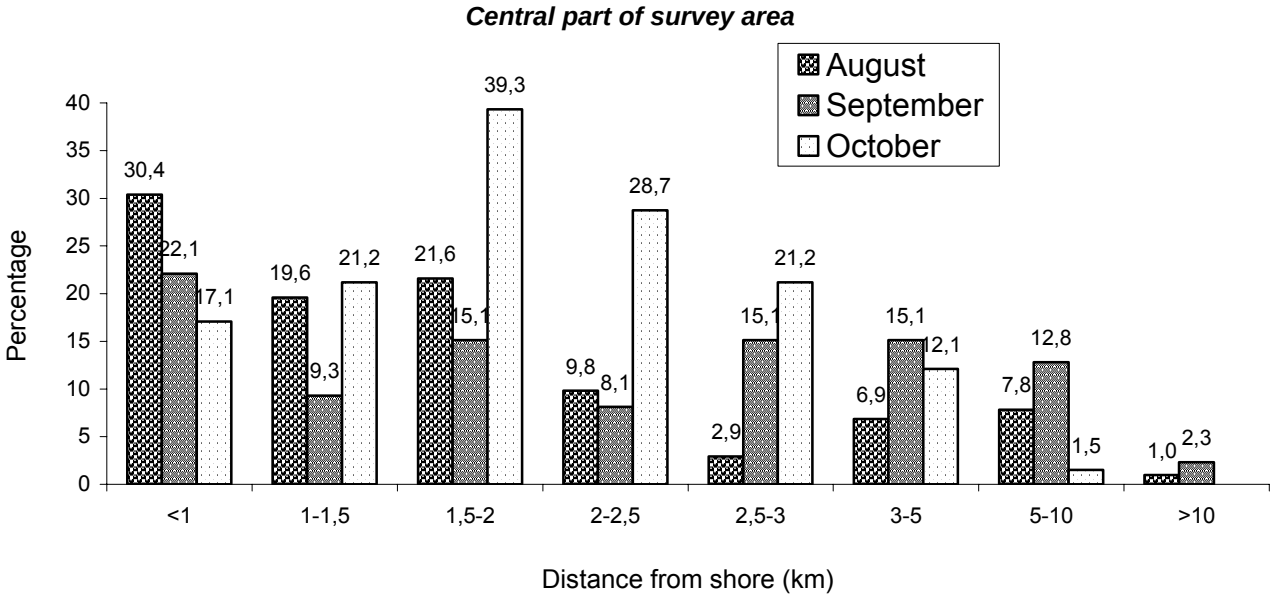
Date	Number of "Cow-calf" pairs	Calves
08/13	5	1
08/18	4	0
08/19	1	0
08/28	2	0
09/05	3	1
09/06	2	0
09/13	2	3
09/21	0	0
09/23	1	1
10/05	1	0
10/10	0	0
10/13	0	0

The encounter of a calf without its mother on 13 August indicated that the transitional process of an calf becoming independent had begun prior to the commencement of our study. The number of cow-calf pairs recorded from August to October gradually decreased (Table 13). The last such pair was sighted on 5 October. Sighting calves from shore with confidence is quite difficult, therefore the numbers we produced (Table 13) are probably understated.

Nonetheless, these numbers apparently still reflect the dynamics of “cow-calf” pairs’ breaking up and calves’ transition to an independent way of life.

In published materials there is little data on how much time it takes for calves to become independent. According to data from Weller et al. (1999), “cow-calf” pairs break up between 8 July and 13 August, and separate for good between 3 and 17 September. The later encounters we had of cow-calf pairs can be explained, apparently, by the later dates of our survey.





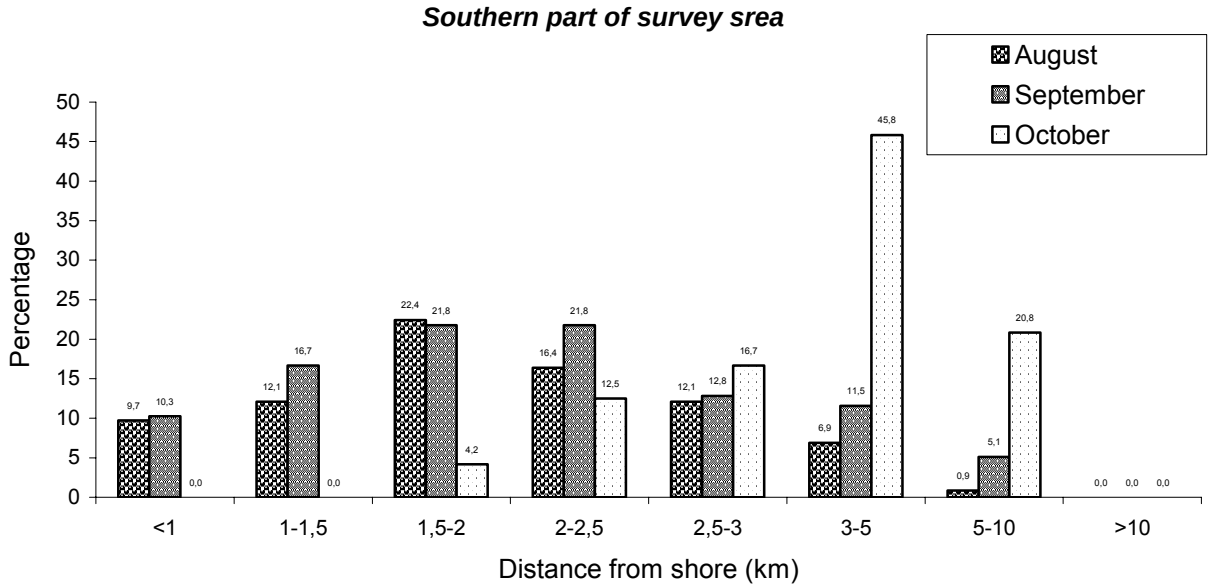


Figure 33. Frequency Distribution of Recorded Whales Versus Distance from Shore.

CONCLUSION

Almost 15 years have already passed since TINRO completed its large-scale study to search for and conduct aerial observations of possible gray whale habitats in the Sea of Okhotsk. Other than off the NE Sakhalin coast, at this time we have virtually no information on the distribution of the Okhotsk-Korean population of gray whales in the Sea of Okhotsk. Without this information, any judgments as to the condition of this population will inevitably be limited and serious mistakes are possible.

The work done in 2003 made it possible to realize the idea of conducting onshore route surveys of gray whales using an automobile. We were able to develop, and in the field refine, a method for onshore route whale surveys. The method employed enabled us to calculate the coordinates of each sighted whale or group of whales. The high effectiveness of this method allowed us to demonstrate that, on average, there are 56.6 gray whales (min 36, max 70) in the Odoptu-Piltun area during the summer. The method employed made it possible to get a detailed picture of the distribution of gray whales in this area for every 10 days of the month. It was discovered that both single whales and groups of whales approached the study area from the north on 14 and 15 August. The significant seasonal fluctuation in the distribution of the gray whales was tracked. It was shown that as autumn approaches, the gray whales move from the area near the mouth of the Piltun Bay to the north, into the Odoptu Bay area. It was discovered that in late August and early September congregations of 20-30 whales begin to form, which perform slow, coordinated movements along the coast, headed toward the Odoptu Bay area and farther north, and then along the shore in the reverse seaward direction. Such congregations often included groups exhibiting behavior that was previously described for mating gray whales in waters off Chukotka (Tomilin, 1937; Bogoslovskaya et al., 1981; Ljungblood et al.,1987).

The studies revealed the great significance of the sand bars in the littoral of the Odoptu-Piltun area, both for gray whale mothers and their offspring. The littoral shelf is used to train calves to feed as they make the transition to an independent way of life. For adult gray whales, feeding in small groups at local feeding areas among the sand banks and along the banks' outer boundary, or in the outflow area from Piltun Bay, is typical.

The studies revealed a statistically-reliable greater number of whales in groups in September than in August and decrease of this parameter by October.

As autumn approached, gray whales in the southern part of the survey area moved away from shore, while in the northern part they did the opposite and began keeping closer to shore.

In 2003, as part of the onshore route surveys in the Odoptu-Piltun area, seven gray whale calves were sighted. In relation to the greatest recorded number of adult animals (70 head), this number represents 10%. This indicator, both the recorded number of calves and the proportion of offspring, represents the highest value ever recorded for this area (Weller et al., 1999, 2003). Calves' transition to an independent way of life proved to take more time as well.

The observations that were made indicate that the gray whales have a negative reaction to being followed by research motor boats, and to helicopters that fly over them at low altitudes. Presently these are the main factors causing a disturbance in the study area.

In the Odoptu Bay area, where in 2004 the construction of a temporary barge dock is planned, there were few gray whales, especially during the summer, and at the northernmost edge of the study area they were seen only once. Because of this, the installation and operation of the temporary dock should not have a serious negative impact on the condition of the Okhotsk-Korean gray whale population. To minimize its potential impact on the animals as much as possible, we suggest moving the dock to the north as far as possible and building it a bit south of the entry into Odoptu Bay, where the seafloor and shore are structurally similar.

RECOMMENDATIONS

1. The onshore route gray whale surveys should be continued.
2. In order to have more complete information on the gray whales distribution in the Piltun feeding grounds, it is imperative that a second group of observers be organized to do work from the Astokh Bar south of the mouth of Piltun Bay
3. Whale surveying work performed from shore must be coordinated both internally and with any water craft surveying being done in the Marine area.
4. It is not essential that a big truck be used for the onshore route surveys; it would be more reasonable to use less powerful transport vehicles with good clearance and a lower operating cost.
5. To minimize as much as possible the potential impact of the planned barge dock construction, we recommend moving the dock to the north and operating it as far north as practicable.
6. It is recommended that work be done to search out gray whales at other potential feeding areas in the Sea of Okhotsk.

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APPENDIX 1. ONSHORE OBSERVATION ROUTE TECHNIQUE FOR GRAY WHALES SURVEY FROM THE NORTHEASTERN SAKHALIN ISLAND COAST.

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ONSHORE OBSERVATION ROUTE TECHNIQUE FOR GRAY WHALES SURVEY FROM THE NORTHEASTERN SAKHALIN ISLAND COAST

The challenge of preserving the dwindling and nearly extinct Okhotsk-Korean (western) gray whale population *(Eschrichtius robustus)* that dwells off NE Sakhalin in the summer and autumn has grown particularly acute as of late. According to recent data, its population totals only about 100-120 whales. These gray whales have been listed among the highest categories of the Red List of Endangered Animal Species published by the International Union for Nature Conservation and Russia's Red Book. This whale population's primary foraging area coincides almost exactly with the area where the Piltun-Astokh and Odoptu oil fields are being developed, which explains the need to conduct ongoing monitoring of this population and an investigation of the most critical aspects of these animals' biology.

Purpose and Objectives

The specific purpose of the onshore motor vehicle survey is:

- to determine the temporal and spatial distribution of gray whales and other marine mammal species along the NE Sakhalin coast;
- to obtain data on the impact of industrial activity on the distribution of gray whales and other marine mammal species in this area.

This work is being conducted as part of the program "Observation and Monitoring of the Okhotsk-Korean Gray Whale Population off the Northeastern Sakhalin Island Coast in the Year 2003".

This gray whale observations and monitoring program will be funded jointly by the oil production companies Exxon Neftegas Ltd. (ENL) and Sakhalin Energy Investment Company Ltd. (SEIC).

This document has been prepared based on the methodology for conducting onshore surveys from Cape Barrow (Zeh et al.1993) and from the shore of the Chukotka Peninsula (Melnikov et al., 2001a; 2001b), on a program by an unknown author provided by ENL, and on methods for conducting gray whale surveys in the vicinity of Unimak Pass (Rugh, 1984) and off California (Realy, 1980; 1984; Buckland et al., 1993).

The objective of this manuscript is:

- to describe a method for visual observation of gray whales from the NE Sakhalin coast using an automobile;
- to instruct and train the relevant personnel in survey methods
- to develop methods for recording the resulting data
- to develop work safety procedures for performing this work

Observation Techniques

Work period: A gray whale survey between the coordinates 53° 13' and 53° 23' N. lat. shall be conducted from automobiles daily over the course of 90 days, assuming sufficient visibility. A gray whale survey between 53° 13' N. lat. and the inlet into the Piltun Lagoon shall be conducted for 5 days during the aerial survey work: for two days prior to the scheduled aerial survey, the day of the aerial survey, and for two days afterward.

Training

Prior to startup of the onshore survey, the technical support for the survey work must be provided, and the participants instructed and trained. It is essential that the participants have prior experience in identifying marine mammal species. The onshore route survey team personnel must be able to::

1. identify the marine mammal species inhabiting the operating area and be able to distinguish them easily on the water surface.
2. know and easily handle the code table, know how to use the codes when filling out survey forms.
3. know how to distinguish categories of weather and visibility, use binoculars competently, know how to record correctly appropriate parameters in the table.
4. know and recognize behavioral patterns of gray whales and other marine mammal species, and to record them properly.
5. be cautious when driving the motor vehicle, observe safety regulations.

Layout of the Observation Stations

The whale account is scheduled to be conducted from observation stations located along the shoreline. The coordinates and altitude of each observation station must be determined using a
personal navigator. The observation station altitude above sea level is a very important parameter that affects the accuracy of determining the distance to the detected animal and the field of view area. Therefore the observation station must be situated as high as possible, and its altitude parameters must be double-checked using other methods and must be defined as precisely as possible. The observation station must be situated conveniently on a high and level site, and be clearly designated and numbered. The observation stations must be situated so that the fields of view of neighboring observation stations partially overlap one another. The distance between observation stations shall be determined by the specific nature of the coast, but be no more than 6 km. Traveling between observation stations shall be done by motor vehicle. While traveling from one observation station to the next, the coastal waters must be monitored to avoid missing any whales.
For ease of recording data, a surveyor's table shall be set up, which shall hold the survey form, the code table, and a pencil. The observers shall have with them a reserve supply of blank forms. Along with the pencil recording, an audio tape recording must be made at the same time. During the survey there must be a photographic camera on hand for photographing the animals and any unusual phenomena or animal behavior.

Observations

During the survey there must be code tables and a pencil on the surveyor's table. There must be a reserve supply of blank forms. In filling out the survey forms, the code tables must be correctly and consistently applied and only the codes indicated must be used. Any unusual parameters or behavioral patterns are to be recorded in the comments column. It is best to use water-resistant paper for the code tables in case of rain. During the survey one must remember that the binoculars' field of view is narrow and different from that of the naked eye. Therefore, it is important to alternate making observations with and without the binoculars. If two observers are observing at the same time, then the field of view should be divided with each observer responsible for a different field of view. In order to avoid any human error, the observers should trade off fields of view. If one observer sights an animal, the other observer must enter the appropriate parameters on the survey form.

Filling out the Form

The survey date and the surveyors' surnames and initials must be indicated in the heading of the form. The pages shall be numbered separately for each date.

1st column – sequential line number

2nd column – observation station number. Given once for all entries made during a survey period from a particular observation station.

3rd column – time. A survey is conducted continuously for 15 minutes from each observation station. The first entry for each observation station gives the survey start time. Thereafter, for any animals sighted from this same observation station the time is not given, and sighting parameters are recorded on a separate line.

4th column – visibility category (observational conditions). This is an important factor that strongly affects the survey results. It is recorded for each observation station individually at the time work is begun from that location. It is important that this parameter be evaluated the same by all observers using the code ranking scale. Visibility is broken down into seven categories, each of which has its own code.

Excellent (EX) no wind, a smooth water surface, the slight effects of a mirage may be noticeable. Topographical contours are clear and distinct even at great distances. The angle at which the sun is located ensures there is no glare on the water.

Very good (VG) wave action, mist, mirages and glare do not have a significant effect on whale surveying conditions. Visibility of more than 20 kilometers.

Good (GD) small waves, visibility up to 20 kilometers. Mist, fog, or mirage hinders the ability to detect whales more than 10 km away.

Fair (FR) wind, waves, rain, fog, or glare hinder the survey, at times visibility may be less than 10 kilometers, white-caps begin to appear on the wave crests, which, however, within the visibility range do not have a significant effect on the survey.

Poor (PR) strong wind, fog, glare, or breaking waves hinder the survey. Only with difficulty can the whale spout be spotted among the breaking waves. The whale's profile is not visible. Visibility of less than 5 km.

Unacceptable (UA) whale survey is impossible. Dense fog, strong wind, waves and breaking waves preclude the possibility of a survey.

5th column – weather. Weather conditions supplement visibility data. The main weather categories are recorded. **CR** clear; **LC** light clouds; **CL** cloudy or overcast; **LF** light fog; **DF** dense fog; **DR** drizzling rain; **LR** light rain; **HR** heavy rain; **LS** light snow; **HS** heavy snow.

6th column – wind speed, estimated in meters per second, preferably using instruments

7th column – white-caps (breaking waves). Indicates the presence of white-caps on the wave crests.

None (NN) there are no white-caps, the water surface is smooth.

Ripple waves (RW) – there are ripple waves on the water surface, however white-caps are non-existent or rare.

Slight (SL) – small and infrequent white-caps are visible on the waves' surface, but they do not hinder the detection of a whale's profile or spout.

Moderate (MD) – a large number of white-caps are visible on the surface. The survey is impeded, a whale can be detected by its spout but its profile is hard to distinguish or is not visible.

Strong (STR) – there are white-caps everywhere on the water surface. The whale survey is impossible, since the whale's spout is barely distinguishable or completely indistinguishable against a dense background of breaking waves and sea foam.

8th column – glare. Indicates the presence of solar glare on the water surface.

None (NN) – no glare. Either the weather is overcast or the sun is coming from behind.

Slight (SL) – slight glare, with no effect on the likelihood of detecting a whale. The whale spout is visible against the glare.

Moderate (MD) – moderate glare. The sun is directly opposite the observer, or off at an angle, but is somewhat blocked by thin clouds. Only the whale's profile is visible on the surface. It is difficult to look directly at the glare.

Strong (STR) – strong glare. The sun is directly opposite the observer, or off at an angle, and is not blocked by any clouds. Neither the whale's profile nor its spout is visible against the glare. It is impossible to look directly at the glare.

9th column – the presence of any water craft, airplanes, or helicopters. If there are water craft or aircraft, their quantity and type (separated by a forward slash) are indicated.

Airplane (AP)

Helicopter (HCP)

Ship (SH) – large water craft

Boat (BT) – small water craft

10th column – quantity and species of marine mammals. The number of animals is expressed as a numeral, followed by a forward slash and then the species code: GW – gray whale; KW – killer whale; HW – humpback whale; FW – finback whale; WW - white whale; BS – bearded seal; LR – seal (*Phoca vitulina largha*); RS – ringed seal

11th column - correlation. Used when surveying from a stationary location, but not possible to determine when surveying en route.

12th column – vertical angle. This column is for indicating the number of division marks on the binoculars' vertical scale between the line of the horizon and the whale's profile.

13th column – horizontal angle. This column is for indicating the direction of the observed whale's motion, given in degrees according to the binoculars' built-in compass.

14th column – direction of motion. Gives the animal's direction of motion: N- north, S- south, W- west, E – east, NW- northwest, NE – northeast, etc. NONE – means the animal is staying in place. SHR – the animal or animals are located on shore. The latter relates to seal herds.

15th column - behavior. Here is where codes are given reflecting the animals' behavior. Recording the nature of the animals' behavior may prove to be quite difficult. If possible, observations of the animals' behavior should be repeated, since evaluating this parameter based on one observation alone is quite difficult. The information recorded in this column will not be rigorously analyzed. The point is to count whales.

Behavioral codes and their description.

C – customary behavior of feeding animals. Diving – emersion – 2-4 intervening emersions – diving.

D - displaying. The whale displays its head vertically out of the water.

LP- the whale leaps out of the water. The whale sticks out of the water, then falls back into the water with a big splash.

TS – tail smacks. The whale smacks the water surface with its tail-stem and tail fan, or sometimes just tail fan.. During calm weather the sound from this smacking can be heard more than 1 km away.

RST – the whale appears to be floating on the water surface, the blowhole remains at the surface and the whale drifts along with the current.

SB – social behavior. Two or more whales are seen nudging one another, rubbing against one another, displaying their pectoral fins, etc. This may be associated with feeding the young or with mating. If such behavior is observed, it should be monitored carefully and described in detail on the back side of the chart.

? – impossible to determine. It is impossible to comprehend the nature of the behavior due to distance, visibility, or other factors.

TRN - transit. The whale is moving without stopping in one particular direction.

It is not possible to describe all possible whale behavior using the code table, therefore anything unusual about the whales' behavior should be described under the comments section.

16th column - comments. This is a very important column in which anything unusual should be noted that cannot be recorded in the other columns of the chart. In this column it is especially important to indicate the particular characteristics of the social behavior, such as the presence of mother-child pairs.

CODES FOR FILLING OUT THE FORM

4th column - visibility

EX	no wind, a smooth water surface, the slight effects of a mirage may be noticeable. Topographical contours are clear and distinct even at great distances. The angle at which the sun is located ensures there is no glare on the water.
VG	wave action, mist, mirages and glare do not have a significant effect on whale surveying conditions. Visibility of more than 20 kilometers.
GD	small waves, visibility up to 20 kilometers. Mist, fog, or mirage hinders the ability to detect whales more than 10 km away.
FR	wind, waves, rain, fog, or glare hinder the survey, at times visibility may be less than 10 kilometers, white-caps begin to appear on the wave crests, which, however, within the visibility range do not have a significant effect on the survey.
PR	strong wind, fog, glare, or breaking waves hinder the survey. Only with difficulty can the whale spout be spotted among the breaking waves. The whale's profile is not visible. Visibility of less than 5 km.
UA	whale survey is impossible. Dense fog, strong wind, waves and breaking waves preclude the possibility of a survey.

5th column – weather

CR	Clear	**DR**	Drizzling rain
LC	Light clouds	**LR**	Light rain
CL	Cloudy or overcast	**HR**	Heavy rain
LF	Light fog	**LS**	Light snow
DF	Dense fog	**HS**	Heavy snow

7th column – white-caps (breaking waves)

NN	there are no white-caps, the water surface is smooth.
RW	there are ripple waves on the water surface, however white-caps are non-existent or rare.
SL	small and infrequent white-caps are visible on the waves' surface, but they do not hinder the detection of a whale's profile or spout.
MD	a large number of white-caps are visible on the surface. The survey is impeded, a whale can be detected by its spout but its profile is hard to distinguish or is not visible.
STR	there are white-caps everywhere on the water surface. The whale survey is impossible, since the whale's spout is barely distinguishable or completely indistinguishable against a dense background of breaking waves and sea foam.

8th column - glare.

NN	no glare. Either the weather is overcast or the sun is coming from behind.
SL	slight glare, with no effect on the likelihood of detecting a whale.
MD	moderate glare. The sun is directly opposite the observer, or off at an angle, but is somewhat blocked by thin clouds. Only the whale's profile is visible on the surface. It is difficult to look directly at the glare.
STR	strong glare. The sun is directly opposite the observer, or off at an angle, and is not blocked by any clouds. Neither the whale's profile nor its spout is visible against the glare. It is impossible to look directly at the glare.

9th column– the presence of water craft, airplanes, or helicopters

AP	Airplane
HCP	Helicopter
SH	Large water craft
BT	Small water craft

10th column – quantity and species of marine mammals

GW	Gray whale	**WW**	White whale
KW	Killer whale	**BS**	Bearded seal
HW	Humpback whale	**LR**	Seal (*Phoca vitulina largha*)
FW	Finback whale	**RS**	Ringed seal

11th column - correlation

N	New appearance, this animal was never seen before, gives the line № on which the current record is located	**O**	The observer is 100% certain that this is one of the whales previously sighted and knows which number this whale is.
S	A series of divings by the very same whale is visible, the line № on which the first record about this animal appeared is given.	**C**	Certain that this whale was sighted previously, but does not know with which previously sighted whales it can be associated.

14th column – direction of motion.

N	North	**E**	East	**NW**	Northwest
W	West	**NW**	Northwest	**NE**	Northeast
NONE	In place	**SHR**	On shore		

15th column – behavior.

C	Customary behavior of feeding animals. Emersion – 2-4 intervening emersions – diving.
D	The whale displays its head vertically out of the water.
LP	The whale leaps out of the water.
TS	Tail smacks.
RST	Rest, the whale appears to be floating on the water surface.
SB	Social behavior
?	Incomprehensible behavior
TRN	Transit

APPENDIX 2. MARINE MAMMAL SURVEY TABLE IN ODOPTU-PILTUN AREA OFF NE SAKHALIN.

Item	Date	Spotting station No.	Observation start	Observation duration (hr, fractions)	Visi-bility	Species	Num-ber	Direc-tion of movement	Azi--muth	Number of lines from horizon	Distan-ce to whales	Coordinates of counted mammals* Lati-tude	Longi-tude	Distan-ce from shore	Comments
1	24-07-03	2	13:54	0.2	Good	largha seal	5								
2	24-07-03	3a	14:30	0.2	Good	largha seal	1								
3	24-07-03	4	15:05	0.33	Good	gray whale	1		46	4.0	5845	53	143	4759	
4	24-07-03	5	16:30	0.3		gray whale	1		95	6.0	5378	53	143	5279	
5	24-07-03	5				gray whale	2		80	10.0	3074	53	143	3067	
6	24-07-03	5				gray whale	1		30	6.0	5378	53	143	3161	
7	28-07-03	2	12:40	0.25	FR	largha seal	3								Feed. near shore
8	28-07-03	3	13:05	0.25	FR	gray whale	1	S	130	6.0	3128	53	143	2011	
9	28-07-03	3				largha seal	15						143		Feed. near shore
10	28-07-03	4	14:15	0.25	FR	gray whale	1		80	6.0	3622	53	143	3620	
11	28-07-03	4				gray whale	1	S	40	24.0	865	53	143	648	Feeding
12	28-07-03	5	15:00	0.25	FR										
13	28-07-03	6	15:30	0.25	FR										
14	09-08-03	1	14:25	0.25	FR	largha seal	3								
15	09-08-03	1				Minke whale	2		15	7.0	1674	53	143	786	
16	09-08-03	2	13:30	0.25	FR	largha seal	1								
17	09-08-03	3	15:15	0.25	FR	gray whale	1	N	104	8.0	2302	53	143	2103	Feeding
18	09-08-03	3				largha seal	5								
19	09-08-03	4	15:45	0.25	PR	largha seal	2								
20	12-08-03	2	7:00	0.25	FR	largha seal	1								
21	12-08-03	3	9:30	0.25											
22	12-08-03	4	10:10	0.25	FR	gray whale	2	N	52	34.0	609	53	143	530	Female+calf
23	12-08-03	5	10:50	0.25	FR	gray whale	2	N	37	15.0	2021	53	143	1378	Feeding
24	12-08-03	6	11:40	0.25	FR	gray whale	1		74	12.0	1515	53	143	1470	
25	12-08-03	7	12:15	0.25	PR	gray whale	1		74	7.0	2167	53	143	2146	
26	12-08-03	8	12:50	0.25	PR	gray whale	1		82	4.0	1868	53	143	1863	
27	12-08-03	9	13:25	0.25	PR	largha seal	4								
28	12-08-03	10	14:25	0.25	PR	largha seal	3								
29	12-08-03	10				gray whale	2		105	5.0	1432	53	143	1383	
30	12-08-03	10				gray whale	2		120	4.0	1815	53	143	1571	
31	12-08-03	11	15:00	0.25	PR	gray whale	2		80	4.0	2889	53	143	2870	
32	12-08-03	11				gray whale	1		100	5.0	2260	53	143	2198	
33	12-08-03	12	15:35	0.25	PR										
34	12-08-03	13	16:38	0.25	PR	gray whale	1		62	6.0	1461	53	143	1302	
35	12-08-03	13				gray whale	1		75	6.0	1461	53	143	1418	
36	12-08-03	14	17:15	0.25	PR										
37	12-08-03	15	17:55	0.25	PR										
38	12-08-03	16	18:30	0.25	PR	gray whale	1		90	7.0	1158	53	143	1158	
39	12-08-03	16				gray whale	1		105	10.0	805	53	143	774	
40	13-08-03	16	10:15	0.25	FR	gray whale	1		121	5.0	1642	53	143	1393	
41	13-08-03	16				gray whale	3		141	3.0	2884	53	143	1776	Female+calf
42	13-08-03	15	10:55	0.25	FR	gray whale	2		109	12.0	838	53	143	787	Female+calf
43	13-08-03	15				gray whale	1		37	15.0	669	53	143	412	yearling
44	13-08-03	15				gray whale	1		88	7.0	1452	53	143	1452	
45	13-08-03	15				gray whale	2		129	3.0	3689	53	143	2826	
46	13-08-03	15-14	11:20		FR	gray whale	2		72	7.0	431	53	143	412	Female+calf
47	13-08-03	15-14	11:30		FR	gray whale	2		145	3.0	1205	53	143	674	
48	13-08-03	15-14				gray whale	1		122	6.0	588	53	143	493	
49	13-08-03	15-14	11:41		FR	gray whale	1		117	15.0	200	53	143	177	
50	13-08-03	15-14				gray whale	1		42	3.0	1028	53	143	701	
51	13-08-03	15-14				gray whale	1		43	6.0	503	53	143	350	
52	13-08-03	14	11:50	0.25	FR	gray whale	1		89	4.0	1203	53	143	1200	
53	13-08-03	14-13	12:15	0.16	FR	gray whale	2		115	4.0	1020	53	143	917	Female+calf
54	13-08-03	14-13				gray whale	1		77	4.0	1020	53	143	998	
55	13-08-03	13	12:35	0.25	FR	gray whale	1		41	4.0	2249	53	143	1505	
56	13-08-03	13-12	13:10	0.16		gray whale	1		152	3.0	1028	53	143	418	
57	13-08-03	12	13:30	0.25	FR	gray whale	1		143	4.0	1815	53	143	975	
58	13-08-03	12				gray whale	2		60	3.0	2496	53	143	2253	
59	13-08-03	12				gray whale	1		35	3.0	2496	53	143	1588	

*Coordinates of these marine mammals may not be precise.

Item	Date	Spotting station No.	Observation start	Observation duration (hr, fractions)	Visi-bility	Species	Num-ber	Direc-tion of movement	Azi--muth	Number of lines from horizon	Distan-ce to whales	Coordinates of spot. whales Lati-tude	Longi-tude	Distan-ce from shore	Comments
60	13-08-03	12				gray whale	1		18	8.0	883	53	143	338	
61	13-08-03	11	14:15	0.25	Good	gray whale	2		90	5.0	2260	53	143	2256	
62	13-08-03	11				gray whale	2		88	3.0	4066	53	143	4064	
63	13-08-03	11				gray whale	2		174	10.0	1099	53	143	48	Female+calf
64	13-08-03	11				bearded seal	40								yearling
65	13-08-03	11-10	15:10	0.16	Good	bearded seal+r	30								
66	13-08-03	10	15:25	0.25	Good	gray whale	5	N	118	4.0	1815	53	143	1602	Feeding
67	13-08-03	10				bearded seal+r	30								
68	13-08-03	9	15:56	0.25	Good	bearded seal+r	10								
69	13-08-03	8	16:29	0.25	FR	bearded seal	5								
70	13-08-03	7	17:00	0.25	FR										
71	13-08-03	6	17:30	0.25	FR										
72	13-08-03	5	18:15	0.25	FR	gray whale	1		57	10.0	3074	53	143	2739	
73	13-08-03	5				gray whale	3		146	8.0	3899	53	143	1830	
74	13-08-03	4	18:45	0.25	FR	gray whale	1		142	4.0	5845	53	143	2878	
75	13-08-03	4				gray whale	1		140	4.0	5845	53	143	3054	
76	13-08-03	4				gray whale	1		35	5.0	4451	53	143	3064	
77	13-08-03	4				gray whale	1		37	5.0	4451	53	143	3175	
78	13-08-03	3	19:07	0.25	FR	gray whale	1		115	7.0	2650	53	143	2171	
79	13-08-03	2	19:35	0.25	FR	gray whale	2		80	2.3	12536	53	143	12513	
80	13-08-03	1	20:07	0.25	FR										
81	14-08-03	1	13:25	0.25	Very goo	gray whale	2		136	8.0	1458	53	143	751	Female+calf
82	14-08-03	1				gray whale	2		115	2.0	8764	53	143	6906	
83	14-08-03	2	14:07	0.25	Very goo	gray whale	1		91	2.3	12536	53	143	12137	
84	14-08-03	2				gray whale	4	S	67	3.0	6660	53	143	6569	
85	14-08-03	2				bearded seal	2								
86	14-08-03	3	14:41	0.25	Very goo	gray whale	1	S fast	90	7.0	2650	53	143	2610	
87	14-08-03	4	15:06	0.25	Very goo	gray whale	1	S fast	94	5.0	4451	53	143	4345	
88	14-08-03	5	15:47	0.25	Very goo	gray whale	1	S fast	96	8.0	3899	53	143	3814	
89	14-08-03	6	16:32	0.25	Good	gray whale	1		160	4.0	4988	53	143	1541	
90	14-08-03	6				gray whale	3		35	5.0	3830	53	143	2305	
91	15-08-03	1	9:10	0.25	FR										
92	15-08-03	2	9:45	0.25	FR	gray whale	2	S fast	77	8.0	2106	53	143	2106	
93	15-08-03	2				gray whale	1	S fast	38	6.0	2857	53	143	2236	
94	15-08-03	3	10:15	0.25	FR	gray whale	1		22	4.0	4988	53	143	2643	
95	15-08-03	4	10:40	0.25	FR	gray whale	1	S fast	47	10.0	2105	53	143	1735	
96	15-08-03	1	16:42	0.25	PR	gray whale	1	S fast	70	5.0	2390	53	143	2372	
97	15-08-03	2	17:20	0.25	PR	gray whale	1	S fast	101	7.0	2423	53	143	2205	
98	18-08-03	1	7:25	0.25	PR	largha seal	1								
99	18-08-03	2	8:00	0.25	PR	largha seal	1								
100	18-08-03	3	8:28	0.25	PR										
101	18-08-03	4	11:45	0.25	PR	largha seal	1								
102	18-08-03	5	12:16	0.25	FR	gray whale	1		63	19.0	1589	53	143	1484	
103	18-08-03	5				gray whale	3		100	4.0	9138	53	143	8784	
104	18-08-03	5				gray whale	2		103	4.0	9138	53	143	8641	
105	18-08-03	5				gray whale	2		87	17.0	1779	53	143	1777	
106	18-08-03	6	12:54	0.25	FR	gray whale	2		74	5.0	3830	53	143	3716	
107	18-08-03	7	13:25	0.25	FR										
108	18-08-03	8	13:54	0.25	FR	gray whale	1		134	8.0	908	53	143	613	
109	18-08-03	9	14:30	0.25	FR	gray whale	1		66	4.0	2497	53	143	2339	
110	18-08-03	9				gray whale	2		23	10.0	957	53	143	427	Female+calf
111	18-08-03	10	15:03	0.25	FR	gray whale	1		163	6.0	1185	53	143	346	
112	18-08-03	11	15:35	0.25	FR	gray whale	1		106	5.0	2260	53	143	2131	
113	18-08-03	11				gray whale	2		125	7.0	1585	53	143	1241	
114	18-08-03	12	16:06	0.25	Good	gray whale	1		163	4.0	1815	53	143	393	
115	18-08-03	12				gray whale	1		146	4.0	1815	53	143	894	
116	18-08-03	12				gray whale	1		158	4.0	1815	53	143	546	
117	18-08-03	12				gray whale	4	S fast	37	4.0	1815	53	143	1202	
118	18-08-03	13	17:00	0.25	Good	gray whale	1		10	2.5	3923	53	143	749	
119	18-08-03	13				gray whale	6		155	3.0	3122	53	143	1270	Female+calf

Item	Date	Spotting station	Observation start	Observation duration	Visi-bility	Species	Num-ber	Direc-tion of movement	Azi--muth	Number of lines from horizon	Distan-ce to whales	Coordinates of spot. whales		Distan-ce from shore	Comments
		No.	(hr, fractions)									Lati-tude	Longi-tude		
120	18-08-03	13				gray whale	1		12	6.0	1461	53	143	329	
121	18-08-03	13				gray whale	2		98	5.0	1769	53	143	1747	
122	18-08-03	13				gray whale	1		110	3.0	3122	53	143	2914	
123	18-08-03	13				gray whale	1		42	5.0	1769	53	143	1207	
124	18-08-03	13				gray whale	1		65	5.0	1769	53	143	1616	
125	18-08-03	13				gray whale	1		132	3.0	3122	53	143	2283	
126	18-08-03	14	17:35	0.25	Good	gray whale	3		122	4.0	1203	53	143	961	
127	18-08-03	14				gray whale	1		75	2.5	2006	53	143	1976	
128	18-08-03	14				gray whale	1		169	5.0	954	53	143	100	
129	18-08-03	14				gray whale	1		95	3.0	1637	53	143	1612	
130	18-08-03	15	18:12	0.25	Good	gray whale	2		100	5.0	2067	53	143	2029	
131	18-08-03	15				gray whale	1		98	5.0	2067	53	143	2042	
132	18-08-03	15				gray whale	1		88	4.0	2636	53	143	2636	
133	18-08-03	15				gray whale	3		84	5.0	2067	53	143	2059	
134	18-08-03	15				gray whale	2		68	5.0	2067	53	143	1930	
135	18-08-03	15				gray whale	1		25	3.0	3689	53	143	1617	
136	18-08-03	15				gray whale	1		75	4.0	2636	53	143	2558	
137	18-08-03	15				gray whale	1		31	3.0	3689	53	143	1955	
138	18-08-03	15				gray whale	1		33	5.0	2067	53	143	1156	
139	18-08-03	15				gray whale	2		48	4.0	2636	53	143	1990	
140	18-08-03	16	18:52	0.25	Good	gray whale	1		88	4.0	2085	53	143	2085	
141	18-08-03	16				gray whale	1		102	2.0	4969	53	143	4841	
142	18-08-03	16				gray whale	2	N	16	4.0	2085	53	143	610	Female+calf
143	18-08-03	16				gray whale	2	S	102	12.0	670	53	143	652	Female+calf
144	18-08-03	16				gray whale	1		175	4.0	2085	53	143	145	
145	18-08-03	16				gray whale	1		117	3.0	2884	53	143	2547	
146	19-08-03	16	9:38	0.25	Good	gray whale	1		157	3.0	2884	53	143	1080	
147	19-08-03	16				gray whale	1		155	3.0	2884	53	143	1173	
148	19-08-03	16				gray whale	4		7	5.0	1642	53	143	229	Female+calf
149	19-08-03	16				gray whale	1		149	5.0	1642	53	143	821	
150	19-08-03	16				gray whale	2		25	2.0	4969	53	143	2178	
151	19-08-03	16				gray whale	1		23	3.0	2884	53	143	1173	
152	19-08-03	16				gray whale	1		5	6.0	1357	53	143	142	
153	19-08-03	16				gray whale	1		57	3.0	2884	53	143	2446	
154	19-08-03	16				gray whale	2		60	4.0	2085	53	143	1824	
155	19-08-03	15	10:25	0.25	Good	gray whale	3		116	4.0	2636	53	143	2349	
156	19-08-03	15				gray whale	1		67	6.0	1705	53	143	1581	
157	19-08-03	15				gray whale	1		170	10.0	1008	53	143	158	
158	19-08-03	15				gray whale	1		85	6.0	1705	53	143	1701	
159	19-08-03	15				gray whale	1		33	4.0	2636	53	143	1474	
160	19-08-03	15				gray whale	1		11	4.0	2636	53	143	548	
161	19-08-03	14	10:55	0.25	Good										
162	19-08-03	13	11:25	0.25	Good	gray whale	4		40	3.5	2610	53	143	1712	
163	19-08-03	12	12:00	0.25	FR	gray whale	1		143	4.0	1815	53	143	1214	
164	19-08-03	12				gray whale	1		110	17.0	413	53	143	375	
165	19-08-03	12				gray whale	1		170	4.0	1815	53	143	174	
166	19-08-03	12				gray whale	1		55	4.0	1815	53	143	1564	
167	19-08-03	12				gray whale	1		36	10.0	704	53	143	457	
168	19-08-03	11	12:30	0.25	FR	gray whale	1		22	3.0	4066	53	143	1750	
169	19-08-03	11				gray whale	1		50	3.0	4066	53	143	3268	
170	19-08-03	10	13:00	0.25	FR										
171	19-08-03	9	13:34	0.25	FR										
172	19-08-03	8	14:32	0.25	FR										
173	19-08-03	7	14:54	0.25	FR										
174	19-08-03	6	15:23	0.25	FR	gray whale	2		90	5.0	3830	53	143	3828	
175	19-08-03	6				gray whale	3		87	5.0	3830	53	143	3830	
176	19-08-03	6				gray whale	1		110	6.0	3128	53	143	2900	
177	19-08-03	6				gray whale	1		57	5.0	3830	53	143	3283	
178	19-08-03	5	16:03	0.25	FR										
179	19-08-03	4	16:30	0.25	FR	gray whale	1		136	10.0	2105	53	143	1222	

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180	19-08-03	3	16:53	0.25	FR	gray whale	1		109	3.0	7453	53	143	6519	
181	19-08-03	2	17:22	0.25	FR										
182	19-08-03	1	17:54	0.25	Good										
183	20-08-03	1	14:50	0.25	Very goo	gray whale	3		105	3.0	4322	53	143	3816	
184	20-08-03	2	15:25	0.25	Very good										Airplane
185	20-08-03	3	15:55	0.25	Very goo	gray whale	4		125	7.0	2650	53	143	1874	
186	20-08-03	4	16:20	0.25	Very goo	gray whale	1		148	5.0	4451	53	143	1775	
187	20-08-03	4				gray whale	2		31	5.0	4451	53	143	2831	Airplane
188	20-08-03	5	16:50	0.25	Very goo	gray whale	3		104	5.0	6706	53	143	6301	
189	20-08-03	5				gray whale	1		163	4.0	9138	53	143	1744	
190	20-08-03	6	17:31	0.25	Very good										
191	21-08-03	1	14:22	0.25	Excellent										
192	21-08-03	2	15:00	0.25	Excellent										
193	21-08-03	3	15:28	0.25	Very good										
194	21-08-03	4	15:55	0.25	Good										
195	21-08-03	5	16:26	0.25	Good	gray whale	2		80	5.0	6706	53	143	6689	
196	21-08-03	5				gray whale	4		85	15.0	2021	53	143	2021	
197	21-08-03	5				gray whale	1		53	45.0	667	53	143	572	
198	21-08-03	6	17:08	0.25	Good										
199	23-08-03	1	16:41	0.25	Very goo	gray whale	1		145	3.0	4322	53	143	1619	Feeding
200	23-08-03	1				gray whale	1		147	3.0	4322	53	143	1478	Feeding
201	23-08-03	1				gray whale	1		151	3.0	4322	53	143	1191	Feeding
202	23-08-03	2	15:56	0.25	Good										
203	23-08-03	3	17:23	0.25	Very good										
204	23-08-03	4	17:45	0.25	Very goo	gray whale	1		47	4.0	5845	53	143	4817	
205	23-08-03	4				gray whale	1		22	4.0	5845	53	143	2967	
206	23-08-03	5	18:15	0.25	Very goo	gray whale	1		133	10.0	3074	53	143	2017	
207	23-08-03	6	18:52	0.25	Very goo	gray whale	2		110	3.5	5932	53	143	5500	
208	24-08-03	1	16:19	0.25	Good	gray whale	1		97	9.0	1292	53	143	1214	
209	24-08-03	1				gray whale	1		113	5.0	2390	53	143	1933	
210	24-08-03	2	16:54	0.25	Good										
211	24-08-03	3	17:20	0.25	Good	gray whale	2		43	8.0	2302	53	143	1838	
212	24-08-03	4	17:44	0.25	Good										
213	24-08-03	5	18:16	0.25	Good										
214	24-08-03	6	18:56	0.25	Very goo	gray whale	2		133	2.4	13182	53	143	9321	
215	24-08-03	6				gray whale	1		152	4.0	4988	53	143	2187	
216	24-08-03	6				gray whale	1		141	3.0	7453	53	143	4485	
217	24-08-03	6				gray whale	1		146	4.0	4988	53	143	2643	
218	25-08-03	1	14:48	0.25	FR										
219	25-08-03	2	15:21	0.25	FR										
220	25-08-03	3	15:51	0.25	FR	gray whale	3		100	8.0	2302	53	143	2163	
221	25-08-03	3				gray whale	1		87	3.0	7453	53	143	7398	
222	25-08-03	3				gray whale	1		120	5.0	3830	53	143	2934	
223	25-08-03	3				gray whale	1		113	10.0	1826	53	143	1532	
224	25-08-03	4	16:21	0.25	FR										
225	25-08-03	5	16:54	0.25	FR	gray whale	1		153	8.0	3899	53	143	1397	
226	25-08-03	6	17:35	0.25	FR	gray whale	1		43	3.0	7453	53	143	5270	
227	25-08-03	6				gray whale	1	S	81	12.0	1515	53	143	1504	
228	26-08-03	1	7:38	0.25	Good										
229	26-08-03	2	8:09	0.25	Good	gray whale	1	C	65	2.5	9336	53	143	9149	
230	26-08-03	2				gray whale	1		30	6.0	2857	53	143	1966	
231	26-08-03	3	8:36	0.25	Good	largha seal	10								
232	26-08-03	4	9:00	0.25	Good	gray whale	2		73	8.0	2657	53	143	2627	
233	26-08-03	5	9:32	0.25	Good	gray whale	2		36	10.0	3074	53	143	2057	
234	26-08-03	5				gray whale	1		136	8.0	3899	53	143	2400	
235	26-08-03	5				gray whale	1		130	4.0	9138	53	143	6348	
236	26-08-03	5				gray whale	3		82	4.0	9138	53	143	9133	
237	26-08-03	5				gray whale	1		92	14.0	2169	53	143	2148	
238	26-08-03	6	10:13	0.25	Good	gray whale	1		18	4.0	4988	53	143	1706	
239	26-08-03	6				gray whale	1		23	3.0	7453	53	143	3150	

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240	26-08-03	6				gray whale	3		145	2.4	13182	53	143	7179	
241	26-08-03	7	11:40	0.25	Good	gray whale	1		31	3.0	5819	53	143	3662	
242	26-08-03	7				gray whale	1		32	4.0	4016	53	143	2582	
243	26-08-03	7				gray whale	1		90	2.2	11210	53	143	11101	
244	26-08-03	7				gray whale	1		45	3.0	5819	53	143	4647	
245	26-08-03	7				gray whale	2		37	2.2	11210	53	143	7926	
246	26-08-03	7				gray whale	1		40	4.0	4016	53	143	2985	
247	26-08-03	8	12:10	0.25	Good										
248	26-08-03	9	12:40	0.25	Good	bearded seal	15								
249	26-08-03	10	13:07	0.25	Good	gray whale	1		110	4.0	1815	53	143		
250	26-08-03	11	13:40	0.25	Good	gray whale	1		19	1.9	9340	53	143	3574	
251	26-08-03	11				Minke whale	1		58	4.0	2889	53	143	2539	
252	26-08-03	11				Minke whale	1		31	3.0	4066	53	143	2303	
253	26-08-03	12	14:48	0.25	FR										
254	26-08-03	13	15:20	0.25	FR	gray whale	1		114	1.7	8051	53	143	7297	
255	26-08-03	13				gray whale	1		114	4.0	2249	53	143	2039	
256	26-08-03	13				gray whale	1		30	10.0	866	53	143	446	
257	26-08-03	13				gray whale	2		120	1.7	8051	53	143	6901	
258	26-08-03	14	15:52	0.25	FR	gray whale	2		102	5.0	954	53	143	913	
259	26-08-03	14				gray whale	1		102	1.5	3949	53	143	3777	
260	26-08-03	14				gray whale	1		90	2.0	2619	53	143	2609	
261	26-08-03	15	16:28	0.25	Good	gray whale	2		135	4.0	2636	53	143	1831	
262	26-08-03	15				gray whale	1		161	10.0	1008	53	143	311	
263	26-08-03	15				gray whale	3	S fast	85	4.0	2636	53	143	2630	
264	26-08-03	16	17:02	0.25	Good	gray whale	1		67	5.0	1642	53	143	1523	
265	26-08-03	16				gray whale	2		22	5.0	1642	53	143	642	
266	26-08-03	16				gray whale	5		83	5.0	1642	53	143	1633	
267	26-08-03	16				gray whale	2		129	3.0	2884	53	143	2209	
268	26-08-03	16				gray whale	1		132	2.0	4969	53	143	3634	
269	26-08-03	16				gray whale	2		34	2.0	4969	53	143	2850	
270	26-08-03	16				gray whale	1		134	4.0	2085	53	143	1475	
271	26-08-03	16				gray whale	3		44	2.5	3609	53	143	2552	
272	26-08-03	16				gray whale	1		140	4.0	2085	53	143	1312	
273	26-08-03	16				gray whale	1		67	2.5	3609	53	143	3346	
274	26-08-03	16				gray whale	1		68	5.0	1642	53	143	1533	
275	26-08-03	16				gray whale	1		150	2.5	3609	53	143	1750	
276	28-08-03	16	8:22	0.25	FR	gray whale	3		65	4.0	2085	53	143	1905	
277	28-08-03	16				gray whale	3		153	1.6	8788	53	143	3852	
278	28-08-03	16				gray whale	2		151	3.0	2884	53	143	1354	
279	28-08-03	16				gray whale	1		157	1.6	8788	53	143	3292	
280	28-08-03	16				gray whale	1		152	2.0	4969	53	143	2256	
281	28-08-03	16				gray whale	1		142	2.0	4969	53	143	2990	
282	28-08-03	16				gray whale	1		149	1.6	8788	53	143	4394	
283	28-08-03	16				gray whale	2		145	5.0	1642	53	143	918	
284	28-08-03	16				gray whale	1		137	1.6	8788	53	143	5880	
285	28-08-03	16-15	8:55		FR	gray whale	5		100	13.0	347	53	143	340	Female+calf
286	28-08-03	15	9:07	0.25	FR	gray whale	2	N fast	28	13.0	773	53	143	375	Female+calf
287	28-08-03	15				gray whale	2		67	6.0	1705	53	143	1581	
288	28-08-03	15				gray whale	2		62	4.0	2636	53	143	2349	
289	28-08-03	15				gray whale	2		143	5.0	2067	53	143	1215	
290	28-08-03	15				gray whale	1		87	5.0	2067	53	143	2066	
291	28-08-03	15				gray whale	2		135	5.0	2067	53	143	1436	
292	28-08-03	14	9:37	0.25	FR	gray whale	1	C	168	1.5	3949	53	143	481	
293	28-08-03	14				gray whale	1	C	170	1.5	3949	53	143	344	
294	28-08-03	13	10:10	0.25	FR	Minke whale	1		80	3.0	3122	53	143	3083	
295	28-08-03	12	10:42	0.25	FR	gray whale	1		78	5.0	1432	53	143	1420	

Item	Date	Spotting spotting No.	Observation start	Observation duration	Visi-bility	Species	Num-ber	Direc-tion of movement	Azi--muth	Number of lines from horizon	Distan-ce to whales	Coordinates of spot. whales		Distan-ce from shore	Comments
			(hr, fractions)									Lati-tude	Longi-tude		
296	28-08-03	11	11:13	0.25	FR										
297	28-08-03	10	11:52	0.25	FR	gray whale	1		56	3.0	2496	53	143	2070	
298	28-08-03	9	12:23	0.25	FR										
299	28-08-03	8	13:16	0.25	FR	gray whale	1		105	5.0	1474	53	143	1398	
300	28-08-03	8				gray whale	1		115	5.0	1474	53	143	1295	
301	28-08-03	8				gray whale	1		80	5.0	1474	53	143	1465	
302	28-08-03	7	13:42	0.25	FR	gray whale	1		45	3.0	5819	53	143	4647	
303	28-08-03	6	14:14	0.25	FR	gray whale	1		78	7.0	2650	53	143	2610	
304	28-08-03	6				gray whale	1		162	2.4	13182	53	143	3633	
305	28-08-03	6				gray whale	1		62	3.0	7453	53	143	6699	
306	28-08-03	5	14:58	0.25	FR	gray whale	2		32	8.0	3899	53	143	2400	
307	28-08-03	5				gray whale	1		28	8.0	3899	53	143	2180	
308	28-08-03	5				gray whale	1		73	18.0	1679	53	143	1648	
309	28-08-03	5				gray whale	1		80	12.0	2542	53	143	2536	
310	28-08-03	4	15:31	0.25	FR	gray whale	2		86	8.0	2657	53	143	2648	
311	28-08-03	4				gray whale	2		114	8.0	2657	53	143	2241	
312	28-08-03	4				gray whale	1		81	7.0	3062	53	143	3062	
313	28-08-03	4				gray whale	1		140	4.0	5845	53	143	3054	
314	28-08-03	4				gray whale	1		66	7.0	3062	53	143	2951	
315	28-08-03	3	16:05	0.25	FR	gray whale	2		142	4.0	4988	53	143	2342	
316	28-08-03	3				gray whale	1		60	7.0	2650	53	143	2490	
317	28-08-03	3				gray whale	1		59	10.0	1826	53	143	1705	
318	28-08-03	3				gray whale	2		146	4.0	4988	53	143	2029	
319	28-08-03	2	16:33	0.25	FR	gray whale	1		140	4.0	4527	53	143	2020	
320	28-08-03	1	17:09	0.25	Good	gray whale	1		118	6.0	1967	53	143	1485	
321	28-08-03	1				gray whale	1		92	8.0	1458	53	143	1409	
322	02-09-03	1	14:58	0.25	FR										
323	02-09-03	2	15:30	0.25	FR										
324	02-09-03	3	15:56	0.25	FR	gray whale	1		135	7.0	2650	53	143	1520	
325	02-09-03	4	16:20	0.25	FR										
326	02-09-03	5	17:00	0.25	FR	gray whale	2		99	6.0	5378	53	143	5195	
327	02-09-03	5				gray whale	1		75	15.0	2021	53	143	1996	
328	02-09-03	5				gray whale	1		24	10.0	3074	53	143	1537	
329	02-09-03	5				gray whale	1		64	10.0	3074	53	143	2889	
330	02-09-03	5				gray whale	1		50	3.1	16954	53	143	14056	
331	02-09-03	6	17:38	0.25	Good	gray whale	4		73	4.0	4988	53	143	4818	
332	02-09-03	6				gray whale	1		49	3.0	7453	53	143	5792	
333	02-09-03	6				gray whale	3		71	3.0	7453	53	143	7127	
334	02-09-03	6				gray whale	2		73	3.0	7453	53	143	7199	
335	02-09-03	6				gray whale	1		69	7.0	2650	53	143	2506	
336	02-09-03	6				gray whale	2		132	5.0	3830	53	143	2755	
337	02-09-03	6				gray whale	3		43	6.0	3128	53	143	2212	
338	02-09-03	6				gray whale	1		32	2.4	13182	53	143	7371	
339	03-09-03	1	14:27	0.25	Good										
340	03-09-03	2	14:59	0.25	Good										
341	03-09-03	3	15:25	0.25	Good	gray whale	3		80	2.5	10995	53	143	10995	
342	03-09-03	3				gray whale	5		114	5.0	3830	53	143	3175	
343	03-09-03	3				gray whale	1		132	3.0	7453	53	143	4589	
344	03-09-03	3				gray whale	1		114	3.0	7453	53	143	6179	
345	03-09-03	3				gray whale	1		123	4.0	4988	53	143	3648	
346	03-09-03	4	15:50	0.25	Good	gray whale	2		55	6.0	3622	53	143	3241	
347	03-09-03	4				Minke whale	1		103	5.0	4451	53	143	4141	
348	03-09-03	4				gray whale	1		132	5.0	4451	53	143	2831	
349	03-09-03	5	16:22	0.25	Good	gray whale	1		95	12.0	2542	53	143	2495	
350	03-09-03	5				gray whale	1		24	10.0	3074	53	143	1537	
351	03-09-03	5				gray whale	3		23	3.1	16954	53	143	8220	
352	03-09-03	5				gray whale	1		23	10.0	3074	53	143	1490	
353	03-09-03	5				gray whale	1		105	5.0	6706	53	143	6260	
354	03-09-03	5				gray whale	2		124	13.0	2341	53	143	1793	

Item	Date	Spotting station No.	Observation start	Observation duration	Visi-bility	Species	Num-ber	Direc-tion of movement	Azi--muth	Number of lines from horizon	Distan-ce to whales	Coordinates of spot. whales		Distan-ce from shore	Comments
			(hr, fractions)									Lati-tude	Longi-tude		
355	03-09-03	5				gray whale	4		115	5.0	6706	53	143	5748	
356	03-09-03	5				gray whale	3		112	5.0	6706	53	143	5921	
357	03-09-03	6	17:01	0.25											
358	04-09-03	1	13:37	0.25	Very good										
359	04-09-03	2	14:12	0.25	Very god	gray whale	2		137	5.0	3491	53	143	1719	
360	04-09-03	3	14:38	0.25	Very god	gray whale	2		78	3.0	7453	53	143	7449	
361	04-09-03	3				gray whale	2		68	2.4	13182	53	143	12894	
362	04-09-03	3				gray whale	3		94	3.0	7453	53	143	7232	Soc. behavior
363	04-09-03	4	15:01	0.25	Very god	gray whale	1		98	10.0	2105	53	143	2018	
364	04-09-03	4				gray whale	2		115	8.0	2657	53	143	2215	
365	04-09-03	4				gray whale	1		117	7.0	3062	53	143	2493	
366	04-09-03	5	15:33	0.25	Very god	gray whale	1		25	22.0	1370	53	143	706	
367	04-09-03	5				gray whale	3		52	15.0	2021	53	143	1714	
368	04-09-03	5				gray whale	3		67	17.0	1779	53	143	1701	
369	04-09-03	5				gray whale	1		62	7.0	4514	53	143	4185	
370	04-09-03	5				gray whale	1		60	3.1	16954	53	143	15488	
371	04-09-03	5				gray whale	1		117	6.0	5378	53	143	4511	
372	04-09-03	5				gray whale	1		108	6.0	5378	53	143	4913	
373	04-09-03	6	16:14	0.25	Very god	gray whale	2	N	122	28.0	644	53	143	534	Female+calf
374	04-09-03	6				gray whale	1		35	3.0	7453	53	143	4485	
375	05-09-03	1	7:30	0.25	FR	gray whale	1		53	3.0	4322	53	143	3948	
376	05-09-03	2	8:03	0.25	FR	gray whale	4		62	3.0	6660	53	143	6448	Soc. behavior
377	05-09-03	2				gray whale	1	N	83	3.0	6660	53	143	6618	
378	05-09-03	2				gray whale	1		81	10.0	1672	53	143	1667	
379	05-09-03	2				gray whale	1		56	2.3	12536	53	143	11742	
380	05-09-03	3	8:30	0.25	FR	gray whale	2		75	8.0	2302	53	143	2293	
381	05-09-03	3				gray whale	2		22	22.0	820	53	143	435	Female+calf
382	05-09-03	3				gray whale	1		67	17.0	1064	53	143	1037	
383	05-09-03	3				gray whale	1		60	4.0	4988	53	143	4687	
384	05-09-03	3				gray whale	2		27	6.0	3128	53	143	1882	
385	05-09-03	3				gray whale	1		57	7.0	2650	53	143	2439	
386	05-09-03	3				gray whale	3		92	2.4	13182	53	143	12894	Soc. behavior
387	05-09-03	3				gray whale	1		42	6.0	3128	53	143	2465	
388	05-09-03	3				gray whale	1		112	7.0	2650	53	143	2247	
389	05-09-03	3				gray whale	2		139	9.0	2036	53	143	1049	
390	05-09-03	3				gray whale	1		126	10.0	1826	53	143	1269	
391	05-09-03	4	8:55	0.25	FR	gray whale	1		53	5.0	4451	53	143	3912	
392	05-09-03	4				gray whale	1		14	8.0	2657	53	143	1017	
393	05-09-03	5	9:24	0.25	FR	gray whale	2		149	10.0	3074	53	143	1299	
394	05-09-03	5				gray whale	1		36	8.0	3899	53	143	2609	
395	05-09-03	5				gray whale	1		124	10.0	3074	53	143	2355	
396	05-09-03	6	10:07	0.25	FR	gray whale	2		1	5.0	3830	53	143	200	Female+calf
397	05-09-03	8	10:46	0.25	Good	Minke whale	1		100	3.0	2573	53	143	2502	
398	05-09-03	9	11:14	0.25	Good										
399	05-09-03	10	11:43	0.25	Good	gray whale	1		119	4.0	1815	53	143	1587	
400	05-09-03	11	12:47	0.25	Good	gray whale	1		20	2.0	7897	53	143	3149	
401	05-09-03	11				Minke whale	1		122	2.0	7897	53	143	6429	
402	05-09-03	12	13:24	0.25	Good										
403	05-09-03	13	13:54	0.25	Good	gray whale	1		8	4.0	2249	53	143	352	
404	05-09-03	14	14:24	0.25	Good	gray whale	1		60	15.0	314	53	143	284	yearling
405	05-09-03	15	14:56	0.25	Good	gray whale	1		137	3.0	3689	53	143	2469	
406	05-09-03	15				gray whale	2		140	5.0	2067	53	143	1301	
407	05-09-03	15				gray whale	3		154	2.0	6831	53	143	2887	
408	05-09-03	15				gray whale	1		150	2.8	4026	53	143	1952	
409	05-09-03	15				gray whale	3		158	2.0	6831	53	143	2448	
410	05-09-03	16	15:30	0.25	Good	gray whale	1		6	3.0	2884	53	143	352	
411	05-09-03	16				gray whale	1		135	5.0	1642	53	143	1141	
412	05-09-03	16				gray whale	1		144	5.0	1642	53	143	942	
413	05-09-03	16				gray whale	2		18	5.0	1642	53	143	535	Female+calf

Item	Date	Spotting station No.	Observation start	Observation duration (hr, fractions)	Visi-bility	Species	Num-ber	Direc-tion of movement	Azi--muth	Number of lines from horizon	Distan-ce to whales	Coordinates of spot. whales Lati-tude	Longi-tude	Distan-ce from shore	Comments
414	05-09-03	16				gray whale	1		69	4.0	2085	53	143	1960	
415	05-09-03	16				gray whale	2		50	2.0	4969	53	143	3861	
416	05-09-03	16				gray whale	4		23	2.0	4969	53	143	2021	
417	06-09-03	16	10:03	0.25	Good	gray whale	2		140	4.0	2085	53	143	1312	Female+calf
418	06-09-03	16				gray whale	4		58	4.0	2085	53	143	1787	
419	06-09-03	16				gray whale	6		143	3.0	2884	53	143	1695	
420	06-09-03	16				gray whale	1		93	4.0	2085	53	143	2080	
421	06-09-03	16				gray whale	1		15	2.5	3609	53	143	995	
422	06-09-03	15	10:40	0.25	Good	gray whale	3		142	2.0	6831	53	143	4111	
423	06-09-03	15				gray whale	1		132	7.0	1452	53	143	1062	
424	06-09-03	14	11:10	0.25	Good	Minke whale	1		105	3.5	1386	53	143	1302	
425	06-09-03	13	11:45	0.25	Good	Minke whale	1		57	4.0	2249	53	143	1907	
426	06-09-03	12	12:23	0.25	Good	Minke whale	1		120	3.0	2496	53	143	2057	
427	06-09-03	12				gray whale	1	S fast	118	4.0	1815	53	143	1530	
428	06-09-03	11	12:54	0.25	Very god	Minke whale	1		120	7.0	1585	53	143	1322	
429	06-09-03	10	13:20	0.25	Very good										
430	06-09-03	9	13:52	0.25	Very good										
431	06-09-03	8	14:31	0.25	Very god	gray whale	1		78	3.0	2573	53	143	2545	
432	06-09-03	8				gray whale	2		52	4.0	1868	53	143	1540	
433	06-09-03	8				gray whale	1		75	4.5	1647	53	143	1614	
434	06-09-03	8				gray whale	3		39	2.0	4339	53	143	2931	
435	06-09-03	8				gray whale	2		16	3.0	2573	53	143	859	
436	06-09-03	6	15:31	0.25	Very god	gray whale	2		155	8.0	2302	53	143	899	
437	06-09-03	6				gray whale	4		151	3.0	7453	53	143	3384	
438	06-09-03	6				gray whale	1		80	3.0	7453	53	143	7381	
439	06-09-03	6				gray whale	1		90	3.0	7453	53	143	7449	
440	06-09-03	6				gray whale	1		105	3.0	7453	53	143	7127	
441	06-09-03	6				gray whale	2		88	8.0	2302	53	143	2302	
442	06-09-03	6				gray whale	3		142	4.0	4988	53	143	2932	
443	06-09-03	5	16:13	0.25	Very god	gray whale	1		102	4.0	9138	53	143	8691	
444	06-09-03	5				gray whale	1		103	4.0	9138	53	143	8641	
445	06-09-03	5				gray whale	2		90	4.0	9138	53	143	9088	
446	06-09-03	4	16:41	0.25	Very god	gray whale	2		149	14.0	1491	53	143	571	Female+calf
447	06-09-03	3	17:05	0.25	Very god	gray whale	2		103	7.0	2650	53	143	2439	
448	06-09-03	2	17:28	0.25	Very god	gray whale	1		150	4.5	3937	53	143	1118	
449	06-09-03	2				gray whale	1		113	7.0	2423	53	143	1948	
450	06-09-03	2				gray whale	3		135	6.0	2857	53	143	1493	
451	06-09-03	1	18:00	0.25	Very good										
452	07-09-03	1	14:24	0.25	Good	gray whale	1		115	3.0	4322	53	143	3406	
453	07-09-03	1				gray whale	1		120	9.0	1292	53	143	945	
454	07-09-03	1				gray whale	1		142	3.5	3572	53	143	1509	
455	07-09-03	2	14:57	0.25	Good	коNатка	1		110	2.3	12536	53	143	10454	Bull
456	07-09-03	3	15:23	0.25	Good	gray whale	1	S fast	40	8.0	2302	53	143	1763	
457	07-09-03	3				gray whale	1	S fast	45	8.0	2302	53	143	1886	
458	07-09-03	4	15:47	0.25	Good										
459	07-09-03	5	16:36	0.25	Good	gray whale	2		72	10.0	3074	53	143	3007	
460	07-09-03	5				gray whale	1		35	12.0	2542	53	143	1668	
461	07-09-03	5				gray whale	1		84	7.0	4514	53	143	4514	
462	07-09-03	5				gray whale	1		68	5.0	6706	53	143	6446	
463	07-09-03	6	17:17	0.25	Good	gray whale	2	S	68	3.0	7453	53	143	7004	Soc. behavior
464	07-09-03	6				gray whale	1		75	4.0	4988	53	143	4860	
465	07-09-03	6				gray whale	3		165	2.4	13182	53	143	2965	
466	08-09-03	1	13:56	0.25	Good	gray whale	2		107	7.0	1674	53	143	1450	
467	08-09-03	2	14:29	0.25	Very good										
468	08-09-03	3	14:56	0.25	Very good										
469	08-09-03	4	15:20	0.25	Very good										
470	08-09-03	5	15:46	0.25	Very god	gray whale	3		95	3.1	16954	53	143	16643	
471	08-09-03	5				gray whale	3		118	4.0	9138	53	143	7576	
472	08-09-03	5				gray whale	1		96	5.0	6706	53	143	6559	
473	08-09-03	5				gray whale	1		152	7.0	4514	53	143	1691	

Item	Date	Spotting station No.	Observation start	Observation duration (hr, fractions)	Visi-bility	Species	Num-ber	Direc-tion of movement	Azi--muth	Number of lines from horizon	Distan-ce to whales	Coordinates of spot. whales Lati-tude	Longi-tude	Distan-ce from shore	Comments
474	08-09-03	5				gray whale	1		158	6.0	5378	53	143	1482	
475	08-09-03	6	16:24	0.25	Very goo	gray whale	3		170	1.0	18000	53	143	2505	
476	08-09-03	6				gray whale	2		163	2.4	13182	53	143	3412	
477	08-09-03	6				gray whale	1		168	2.4	13182	53	143	2289	
478	08-09-03	6				gray whale	1		170	2.4	13182	53	143	1835	
479	08-09-03	6				gray whale	1		76	5.0	3830	53	143	3747	
480	08-09-03	6				gray whale	1		65	2.4	13182	53	143	12134	
481	10-09-03	1	10:19	0.25	FR	gray whale	1		68	25.0	461	53	143	455	yearling
482	10-09-03	1				gray whale	1	S	13	3.0	4322	53	143	1895	
483	10-09-03	1				gray whale	1		88	4.0	3059	53	143	3002	
484	10-09-03	1				gray whale	4		31	2.0	8764	53	143	6088	
485	10-09-03	2	11:04	0.25	FR	gray whale	2		88	8.0	2106	53	143	2064	
486	10-09-03	2				gray whale	1		58	9.0	1864	53	143	1767	
487	10-09-03	2				gray whale	2		56	3.0	6660	53	143	6239	
488	10-09-03	2				gray whale	1		56	4.0	4527	53	143	4240	
489	10-09-03	2				gray whale	2		64	3.0	6660	53	143	6503	
490	10-09-03	3	11:30	0.25	FR	gray whale	1		114	4.0	4988	53	143	4135	
491	10-09-03	3				gray whale	1		130	7.0	2650	53	143	1703	
492	10-09-03	3				gray whale	1		118	4.0	4988	53	143	3931	
493	10-09-03	4	11:49	0.25	FR	gray whale	2	S fast	50	8.0	2657	53	143	2265	
494	10-09-03	4				gray whale	1	S fast	90	7.0	3062	53	143	3029	
495	10-09-03	5	12:18	0.25	FR	gray whale	2		88	12.0	2542	53	143	2536	
496	10-09-03	5				gray whale	1		134	7.0	4514	53	143	2902	
497	10-09-03	6	12:52	0.25	FR	gray whale	1		22	3.0	7453	53	143	3031	
498	10-09-03	6				gray whale	2	S	148	4.0	4988	53	143	2494	
499	10-09-03	6				gray whale	2		1	10.0	1826	53	143	96	Female+calf
500	13-09-03	1	8:06	0.25	Excellen	gray whale	1		47	3.0	4322	53	143	3743	
501	13-09-03	2	8:40	0.25	Excellent										
502	13-09-03	3	9:08	0.25	Excellen	gray whale	5		89	5.0	3830	53	143	3783	Soc. behavior
503	13-09-03	3				gray whale	1		61	7.0	2650	53	143	2506	
504	13-09-03	3				gray whale	2	S fast	129	9.0	2036	53	143	1336	
505	13-09-03	3				gray whale	3		130	2.4	13182	53	143	8473	
506	13-09-03	3				gray whale	1		134	5.0	3830	53	143	2251	
507	13-09-03	4	9:33	0.25	Excellen	gray whale	2		99	3.5	7019	53	143	6694	
508	13-09-03	4				gray whale	2		108	5.0	4451	53	143	3983	
509	13-09-03	4				gray whale	1		105	7.0	3062	53	143	2808	
510	13-09-03	5	10:07	0.25	Excellen	gray whale	2		150	3.1	16954	53	143	6896	
511	13-09-03	5				gray whale	1		154	3.4	12336	53	143	4219	
512	13-09-03	5				gray whale	1		150	5.0	6706	53	143	2727	
513	13-09-03	5				gray whale	2		139	4.0	9138	53	143	5242	
514	13-09-03	6	10:50	0.25	Excellen	gray whale	1	S	111	7.0	2650	53	143	2439	
515	13-09-03	6				gray whale	1	S	115	11.0	1656	53	143	1475	
516	13-09-03	6				gray whale	4		130	2.4	13182	53	143	9796	Soc. behavior
517	13-09-03	6				gray whale	1	S	115	5.0	3830	53	143	3413	
518	13-09-03	6				Minke whale	1		109	2.4	13182	53	143	12306	
519	13-09-03	6				gray whale	1	S	113	7.0	2650	53	143	2402	
520	13-09-03	6				gray whale	2	S	125	7.0	2650	53	143	2116	
521	13-09-03	7	11:21	0.25	Very goo	gray whale	1	N	137	6.0	2552	53	143	1464	
522	13-09-03	7				gray whale	1		127	4.0	4016	53	143	2840	
523	13-09-03	8	11:45	0.25	Very goo	gray whale	1		137	5.0	1474	53	143	938	
524	13-09-03	8				gray whale	1		65	4.0	1868	53	143	1738	
525	13-09-03	8				Minke whale	1		129	2.0	4339	53	143	3199	
526	13-09-03	8				gray whale	1		115	4.0	1868	53	143	1642	
527	13-09-03	9	12:14	0.25	Good	gray whale	1		84	4.0	2497	53	143	2495	
528	13-09-03	9				Minke whale	1		38	1.8	8233	53	143	5455	
529	13-09-03	9				Minke whale	1		105	2.5	4411	53	143	4183	
530	13-09-03	10	12:46	0.25	Good	gray whale	1		137	2.5	3102	53	143	2116	
531	13-09-03	10				gray whale	1		134	3.0	2496	53	143	1796	

Item	Date	Spotting station No.	Observation start	Observation duration (hr, fractions)	Visi-bility	Species	Num-ber	Direc-tion of movement	Azi--muth	Number of lines from horizon	Distan-ce to whales	Coordinates of spot. whales Lati-tude	Longi-tude	Distan-ce from shore	Comments
532	13-09-03	11	13:30	0.25	FR	Minke whale	1		110	1.9	9340	53	143	8565	
533	13-09-03	11				gray whale	1		34	3.0	4066	53	143	2475	
534	13-09-03	11				gray whale	1		125	3.0	4066	53	143	3182	
535	13-09-03	11				gray whale	2		112	1.9	9340	53	143	8430	
536	13-09-03	11				gray whale	1		139	3.5	3369	53	143	2051	
537	13-09-03	12	14:15	0.25	FR	gray whale	3		358	2.0	4188	53	143	183	Female+2 underyearlings
538	13-09-03	12				gray whale	1		95	4.0	1815	53	143	1790	
539	13-09-03	12				gray whale	1		38	2.0	4188	53	143	2830	
540	13-09-03	12				gray whale	1		83	1.5	8095	53	143	8088	
541	13-09-03	12				gray whale	1		88	1.5	8095	53	143	8088	
542	13-09-03	13	14:48	0.25	FR										
543	13-09-03	14	15:23	0.25	FR	gray whale	1		75	4.0	1203	53	143	1185	
544	13-09-03	14				gray whale	2		68	8.0	591	53	143	565	Female+underyearling
545	13-09-03	14				gray whale	1		91	4.0	1203	53	143	1197	
546	13-09-03	14				gray whale	2		77	10.0	472	53	143	467	
547	13-09-03	15	15:51	0.25	FR	gray whale	2		31	5.0	2067	53	143	1095	
548	13-09-03	15				gray whale	1		139	4.0	2636	53	143	1695	
549	13-09-03	15				gray whale	1		75	12.0	838	53	143	813	yearling
550	13-09-03	15				gray whale	2		145	3.0	3689	53	143	2063	
551	13-09-03	16	16:23	0.25	FR	gray whale	1		2	3.0	2884	53	143	151	yearling
552	13-09-03	16				gray whale	1		119	4.0	2085	53	143	1806	
553	13-09-03	16				gray whale	1		155	2.0	4969	53	143	2021	
554	13-09-03	16				gray whale	1		59	4.0	2085	53	143	1806	
555	19-09-03	3	12:10	0.25	FR	gray whale	2		85	7.0	2650	53	143	2640	
556	19-09-03	3				gray whale	2		65	2.4	13182	53	143	12733	
557	19-09-03	3				gray whale	1		136	2.4	13182	53	143	7371	
558	19-09-03	3				gray whale	1		115	3.0	7453	53	143	6105	
559	19-09-03	3				gray whale	1		154	2.4	13182	53	143	3633	
560	19-09-03	3				gray whale	1		134	1.0	17000	53	143	9992	
561	19-09-03	3				gray whale	1		39	7.0	2650	53	143	2000	
562	19-09-03	3				gray whale	1		31	7.0	2650	53	143	1739	
563	19-09-03	3				gray whale	1		32	5.0	3830	53	143	2563	
564	19-09-03	3				gray whale	1		42	2.4	13182	53	143	10387	
565	20-09-03	1	7:57	0.25	FR	gray whale	1		90	4.0	3059	53	143	2980	
566	20-09-03	2	9:47	0.25	FR	gray whale	2		82	4.0	4527	53	143	4506	Airplane south
567	20-09-03	2				gray whale	2		104	5.0	3491	53	143	3097	
568	20-09-03	2				gray whale	1		74	10.0	1672	53	143	1670	
569	20-09-03	2				gray whale	2		90	2.3	12536	53	143	12190	
570	20-09-03	3	10:45	0.25	PR	gray whale	1		23	5.0	3830	53	143	2086	
571	20-09-03	3				gray whale	2		135	5.0	3830	53	143	2197	
572	20-09-03	4	15:50	0.25	FR	gray whale	3		115	6.0	3622	53	143	3020	
573	20-09-03	4				gray whale	1		138	2.6	13304	53	143	7343	
574	20-09-03	4				gray whale	2		118	4.0	5845	53	143	4699	
575	20-09-03	4				gray whale	3		127	3.0	9036	53	143	6333	
576	21-09-03	1	7:55	0.25	Very goo	gray whale	2		44	1.9	12085	53	143	10135	
577	21-09-03	2	8:31	0.25	Very goo	gray whale	2		107	10.0	1672	53	143	1441	
578	21-09-03	2				gray whale	4		50	3.5	5358	53	143	4795	
579	21-09-03	2				gray whale	1		95	4.0	4527	53	143	4293	
580	21-09-03	2				gray whale	1		94	12.0	1388	53	143	1323	
581	21-09-03	2				gray whale	1		68	8.0	2106	53	143	2083	
582	21-09-03	2				gray whale	1		125	21.0	788	53	143	522	
583	21-09-03	3	9:04	0.25	Very goo	gray whale	1		135	9.0	2036	53	143	1168	
584	21-09-03	3				gray whale	1		143	7.0	2650	53	143	1203	
585	21-09-03	4	9:29	0.25	Very goo	gray whale	4		107	2.6	13304	53	143	12008	Soc. behavior
586	21-09-03	4				gray whale	1		112	2.6	13304	53	143	11463	
587	21-09-03	4				gray whale	1		57	5.0	4451	53	143	4050	
588	21-09-03	4				gray whale	1		90	3.0	9036	53	143	8937	
589	21-09-03	5	10:00	0.25	Very goo	gray whale	1		50	14.0	2169	53	143	1798	
590	21-09-03	5				gray whale	1		53	14.0	2169	53	143	1859	
591	21-09-03	5				gray whale	2		18	8.0	3899	53	143	1586	

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592	21-09-03	5				gray whale	1		68	7.0	4514	53	143	4339	
593	21-09-03	5				gray whale	1		63	15.0	2021	53	143	1887	
594	21-09-03	5				gray whale	1		62	7.0	4514	53	143	4185	
595	21-09-03	5				gray whale	3		60	3.1	16954	53	143	15488	
596	21-09-03	5				gray whale	3		86	24.0	1255	53	143	1254	
597	21-09-03	5				gray whale	1		46	3.1	16954	53	143	13360	
598	21-09-03	6	10:40	0.25	Very god	gray whale	1		69	6.0	3128	53	143	2958	
599	21-09-03	6				gray whale	1		73	9.0	2036	53	143	1967	
600	21-09-03	6				gray whale	2		132	7.0	2650	53	143	1906	
601	21-09-03	6				gray whale	2		103	7.0	2650	53	143	2560	
602	21-09-03	6				gray whale	2		85	4.5	4326	53	143	4320	
603	21-09-03	7	11:10	0.25	Very god	gray whale	1		81	5.0	3112	53	143	3112	
604	21-09-03	7				gray whale	2		32	7.0	2167	53	143	1393	
605	21-09-03	7				gray whale	1		39	4.0	4016	53	143	2937	
606	21-09-03	7				gray whale	1		35	4.0	4016	53	143	2739	
607	21-09-03	8	11:33	0.25	Very god	gray whale	2		42	10.0	724	53	143	516	
608	21-09-03	9	12:03	0.25	Very good										
609	21-09-03	10	12:57	0.25	Very good										
610	21-09-03	11	13:25	0.25	Very good										
611	21-09-03	12	13:56	0.25	Very good										
612	21-09-03	13	14:29	0.25	FR	gray whale	1		150	6.0	1461	53	143	708	
613	21-09-03	14	15:07	0.25	Good										
614	21-09-03	15	16:00	0.25	Good										
615	21-09-03	16	16:35	0.25	Good	gray whale	1		141	1.6	8788	53	143	5410	
616	21-09-03	16				gray whale	1		142	2.0	4969	53	143	2990	
617	21-09-03	16				gray whale	1		143	1.6	8788	53	143	5165	
618	21-09-03	16				gray whale	3		165	1.6	8788	53	143	2126	
619	21-09-03	16				gray whale	2		150	1.6	8788	53	143	4260	
620	21-09-03	16				gray whale	1		150	3.0	2884	53	143	1398	
621	21-09-03	16				gray whale	2		161	1.6	8788	53	143	2716	
622	21-09-03	16				gray whale	1		153	1.6	8788	53	143	3852	
623	23-09-03	16	9:28	0.25	Very god	gray whale	4		111	3.0	2884	53	143	2674	Soc. behavior
624	23-09-03	16				gray whale	2		112	5.0	1642	53	143	1512	
625	23-09-03	16				gray whale	1		133	3.0	2884	53	143	2075	
626	23-09-03	16				gray whale	3		95	8.0	1010	53	143	1004	Female+underyearling
627	23-09-03	16				gray whale	1		165	2.0	4969	53	143	1202	
628	23-09-03	16				gray whale	1		135	1.6	8788	53	143	6105	
629	23-09-03	16				gray whale	1		5	3.0	2884	53	143	301	yearling
630	23-09-03	16				gray whale	1		153	2.0	4969	53	143	2178	
631	23-09-03	15	10:11	0.25	Very god	gray whale	1		106	3.0	3689	53	143	3528	
632	23-09-03	15				gray whale	1		125	1.8	9445	53	143	7641	
633	23-09-03	14	10:39	0.25	Very god	gray whale	1	N fast	29	6.0	792	53	143	443	
634	23-09-03	13	11:11	0.25	Very good										
635	23-09-03	12	11:41	0.25	Very good										
636	23-09-03	11	12:11	0.25	Very good										
637	23-09-03	10	12:39	0.25	Very god	gray whale	1		104	4.0	1815	53	143	1761	
638	23-09-03	9	13:05	0.25	Very god	Minke whale	1		129	3.5	2903	53	143	2141	
639	23-09-03	8	13:31	0.25	Very god	gray whale	3		25	4.0	1868	53	143	892	
640	23-09-03	8				gray whale	3		48	4.0	1868	53	143	1462	
641	23-09-03	8				gray whale	1		60	4.0	1868	53	143	1672	
642	23-09-03	7	14:34	0.25	Very god	gray whale	2		90	5.0	3112	53	143	3082	
643	23-09-03	7				gray whale	1		100	5.0	3112	53	143	2960	
644	23-09-03	7				gray whale	2		110	10.0	1498	53	143	1322	
645	23-09-03	7				gray whale	1		115	8.0	1885	53	143	1581	
646	23-09-03	6	15:05	0.25	Very god	gray whale	3		74	10.0	1826	53	143	1772	
647	23-09-03	6				gray whale	3		40	3.0	7453	53	143	4987	Soc. behavior
648	23-09-03	6				gray whale	1		125	8.0	2302	53	143	1838	
649	23-09-03	6				gray whale	1		49	4.0	4988	53	143	3877	

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			(hr, fractions)												
650	23-09-03	5	15:49	0.25	Very goo	gray whale	2		71	18.0	1679	53	143	1636	
651	23-09-03	5				gray whale	1		83	15.0	2021	53	143	2021	
652	23-09-03	5				gray whale	3		18	6.0	5378	53	143	2188	
653	23-09-03	5				gray whale	2		50	12.0	2542	53	143	2108	
654	23-09-03	5				gray whale	1		56	15.0	2021	53	143	1785	
655	23-09-03	5				gray whale	1		130	8.0	3899	53	143	2709	
656	23-09-03	5				gray whale	1		150	7.0	4514	53	143	1836	
657	23-09-03	4	16:22	0.25	Very goo	gray whale	3		122	6.0	3622	53	143	2754	
658	23-09-03	3	16:50	0.25	Very goo	gray whale	2		102	4.0	4988	53	143	4625	
659	23-09-03	3				gray whale	4		100	6.0	3128	53	143	2939	
660	23-09-03	2	17:21	0.25	Very good										
661	23-09-03	1	17:54	0.25	Very goo	gray whale	4		113	6.0	1967	53	143	1592	
662	23-09-03	1				gray whale	1		9	2.0	8764	53	143	3283	
663	24-09-03	1	14:15	0.25	FR	gray whale	2		70	2.0	8764	53	143	8698	
664	24-09-03	1				gray whale	1		51	2.0	8764	53	143	7877	
665	24-09-03	1				gray whale	1		54	2.0	8764	53	143	8067	
666	24-09-03	2	14:50	0.25	Good	gray whale	2		57	3.5	5358	53	143	5051	
667	24-09-03	3	15:17	0.25	Good	gray whale	3		90	8.0	2302	53	143	2267	
668	24-09-03	3				gray whale	2		75	7.0	2650	53	143	2640	
669	24-09-03	3				gray whale	2		127	8.0	2302	53	143	1570	
670	24-09-03	3				gray whale	1		135	5.0	3830	53	143	2197	
671	24-09-03	3				gray whale	1		140	12.0	1515	53	143	757	
672	24-09-03	4	15:43	0.25	Good	gray whale	3		126	5.0	4451	53	143	3175	
673	24-09-03	4				gray whale	1		23	6.0	3622	53	143	1892	
674	24-09-03	4				gray whale	1		45	5.0	4451	53	143	3578	
675	24-09-03	4				gray whale	1		50	7.0	3062	53	143	2611	
676	24-09-03	4				gray whale	1		115	5.0	4451	53	143	3712	
677	24-09-03	4				gray whale	2		130	12.0	1745	53	143	1156	
678	24-09-03	5	16:17	0.25	FR	gray whale	2		62	12.0	2542	53	143	2357	
679	24-09-03	5				gray whale	2		38	8.0	3899	53	143	2709	
680	24-09-03	5				gray whale	2		123	28.0	1074	53	143	835	
681	24-09-03	5				gray whale	2		23	6.0	5378	53	143	2607	
682	24-09-03	5				gray whale	2		22	10.0	3074	53	143	1443	
683	24-09-03	5				gray whale	1		125	15.0	2021	53	143	1525	
684	24-09-03	5				gray whale	1		80	16.0	1892	53	143	1888	
685	24-09-03	5				gray whale	1		131	12.0	2542	53	143	1734	
686	24-09-03	5				gray whale	2		131	20.0	1509	53	143	1029	
687	24-09-03	6	17:02	0.25	FR	gray whale	1		30	6.0	3128	53	143	1658	
688	27-09-03	1	11:00	0.25	Very good										
689	27-09-03	2	11:22	0.25	Very goo	gray whale	1		44	6.0	2857	53	143	2409	
690	27-09-03	2				gray whale	1		66	2.5	9336	53	143	9180	
691	27-09-03	3	11:50	0.25	Very goo	gray whale	1		38	8.0	2302	53	143	1711	
692	27-09-03	3				gray whale	1		32	4.0	4988	53	143	3338	
693	27-09-03	3				gray whale	1		119	3.0	7453	53	143	5792	
694	27-09-03	3				gray whale	2		31	6.0	3128	53	143	2052	
695	27-09-03	3				gray whale	1		26	8.0	2302	53	143	1353	
696	27-09-03	4	12:18	0.25	Very goo	gray whale	1		62	4.5	5044	53	143	4754	
697	27-09-03	5	12:47	0.25	Very goo	gray whale	1		138	25.0	1204	53	143	708	
698	27-09-03	5				gray whale	1		101	17.0	1779	53	143	1701	
699	27-09-03	5				gray whale	1		132	2.0	20000	53	143	13383	
700	27-09-03	5				gray whale	1		135	2.5	18000	53	143	11328	
701	27-09-03	5				gray whale	1		160	2.0	20000	53	143	4838	
702	27-09-03	5				gray whale	1		159	3.1	16954	53	143	4388	
703	27-09-03	5				gray whale	1		151	3.1	16954	53	143	6625	
704	27-09-03	5				gray whale	1		155	4.0	9138	53	143	2975	
705	27-09-03	5				gray whale	1		146	7.0	4514	53	143	2119	
706	27-09-03	5				gray whale	10		140	6.0	5378	53	143	3007	
707	27-09-03	5				gray whale	2		163	4.0	9138	53	143	1744	
708	04-10-03	1	8:36	0.25	FR	gray whale	1		79	1.9	12085	53	143	12077	

Item	Date	Spotting station No.	Observation start	Observation duration (hr, fractions)	Visi-bility	Species	Num-ber	Direc-tion of movement	Azi--muth	Number of lines from horizon	Distan-ce to whales	Coordinates of spot. whales Lati-tude	Longi-tude	Distan-ce from shore	Comments
709	04-10-03	2	9:12	0.25	FR	gray whale	1		40	6.0	2857	53	143	2296	
710	04-10-03	2				gray whale	1		120	2.3	12536	53	143	9094	
711	04-10-03	3	9:41	0.25	FR										
712	04-10-03	4	10:05	0.25	FR	gray whale	2		55	9.0	2348	53	143	2101	
713	04-10-03	4				gray whale	1		25	2.6	13304	53	143	7343	
714	04-10-03	5	10:35	0.25	FR	gray whale	1		45	9.0	3436	53	143	2670	
715	04-10-03	5				gray whale	3		50	5.0	6706	53	143	5559	Soc. behavior
716	04-10-03	5				gray whale	2		20	7.0	4514	53	143	1979	
717	04-10-03	6	11:16	0.25	FR	gray whale	1		111	3.0	7453	53	143	6861	
718	04-10-03	6				gray whale	1		100	4.0	4988	53	143	4879	
719	04-10-03	6				gray whale	1		58	9.0	2036	53	143	1763	
720	04-10-03	6				gray whale	1		128	3.5	5932	53	143	4544	
721	04-10-03	6				gray whale	1		32	4.0	4988	53	143	2789	
722	04-10-03	6				gray whale	1		42	5.0	3830	53	143	2661	
723	04-10-03	7	11:50	0.25	FR	gray whale	2		48	2.5	7859	53	143	6515	
724	04-10-03	8	12:20	0.25	FR	gray whale	1		26	2.5	3202	53	143	1577	
725	04-10-03	8				gray whale	1		108	3.0	2573	53	143	2394	
726	04-10-03	8				gray whale	1		124	3.0	2573	53	143	2041	
727	04-10-03	9	12:53	0.25	FR	gray whale	1		46	4.0	2497	53	143	1899	
728	04-10-03	9				gray whale	1		80	4.0	2497	53	143	2481	
729	04-10-03	9				gray whale	1		48	5.0	1960	53	143	1534	
730	04-10-03	10	13:56	0.25	FR										
731	04-10-03	11	14:25	0.25	Good	gray whale	1		145	4.0	2889	53	143	1509	
732	04-10-03	12	14:55	0.25	Good										
733	04-10-03	13	15:26	0.25	Good	gray whale	1		49	3.0	3122	53	143	2391	
734	04-10-03	14	15:56	0.25	Good	gray whale	2		124	1.5	3949	53	143	3069	
735	04-10-03	15	16:27	0.25	Good	gray whale	1		80	3.0	3689	53	143	3644	
736	04-10-03	15				gray whale	3		25	2.0	6831	53	143	2995	
737	04-10-03	15				gray whale	2		37	2.0	6831	53	143	4206	
738	04-10-03	16	16:56	0.25	Good	gray whale	1		111	2.5	3609	53	143	3346	
739	04-10-03	16				gray whale	1		118	2.5	3609	53	143	3156	
740	05-10-03	16	9:05	0.25	Good										
741	05-10-03	15	9:38	0.25	Good	gray whale	2		75	4.0	2636	53	143	2558	
742	05-10-03	15				gray whale	1	N fast	65	3.0	3689	53	143	3370	
743	05-10-03	14	10:10	0.25	Good	gray whale	1		55	1.3	5331	53	143	4617	
744	05-10-03	14				gray whale	1		36	3.0	1637	53	143	1074	
745	05-10-03	13	10:42	0.25	Good	gray whale	4		95	2.0	5477	53	143	5447	
746	05-10-03	13				gray whale	1		87	1.7	8051	53	143	8046	
747	05-10-03	13				gray whale	1		84	2.0	5477	53	143	5456	
748	05-10-03	12	11:19	0.25	Good	gray whale	1		23	7.0	1011	53	143	467	
749	05-10-03	12				gray whale	2	N	67	1.5	8095	53	143	7677	
750	05-10-03	12				gray whale	2	N	64	1.5	8095	53	143	7532	
751	05-10-03	11	11:54	0.25	Good	gray whale	1		89	2.0	7897	53	143	7890	
752	05-10-03	11				gray whale	1		115	2.0	7897	53	143	6940	
753	05-10-03	11				gray whale	1		93	2.0	7897	53	143	7846	
754	05-10-03	11				gray whale	1		112	2.0	7897	53	143	7128	
755	05-10-03	11				gray whale	2		105	1.9	9340	53	143	8858	
756	05-10-03	11				gray whale	1		108	1.9	9340	53	143	8690	
757	05-10-03	11				gray whale	1		104	2.0	7897	53	143	7532	
758	05-10-03	10	12:23	0.25	Good										
759	05-10-03	9	12:57	0.25	Good	gray whale	1		92	3.5	2903	53	143	2890	
760	05-10-03	9				gray whale	1		117	4.0	2497	53	143	2152	
761	05-10-03	9				gray whale	1		100	3.5	2903	53	143	2823	
762	05-10-03	8	13:48	0.25	Good	gray whale	2		95	12.0	602	53	143	596	Female+underyearling
763	05-10-03	8				gray whale	2		130	3.0	2573	53	143	1867	
764	05-10-03	7	14:16	0.25	Good	gray whale	1		53	4.0	4016	53	143	3513	
765	05-10-03	7				gray whale	1		132	4.0	4016	53	143	2582	
766	05-10-03	7				gray whale	2		134	3.0	5819	53	143	3583	

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767	05-10-03	7				gray whale	1		130	4.0	4016	53	143	2688	
768	05-10-03	6	14:49	0.25	Good	gray whale	1		105	5.0	3830	53	143	3663	
769	05-10-03	6				gray whale	1		90	9.5	1925	53	143	1924	
770	05-10-03	6				gray whale	1		58	10.0	1826	53	143	1581	
771	05-10-03	6				gray whale	1		58	3.0	7453	53	143	6455	
772	05-10-03	6				gray whale	1		61	3.5	5932	53	143	5285	
773	05-10-03	6				gray whale	1		62	3.0	7453	53	143	6699	
774	05-10-03	5	15:30	0.25	Very goo	gray whale	1		74	45.0	667	53	143	657	
775	05-10-03	5				gray whale	3		20	5.5	5962	53	143	2613	
776	05-10-03	5				gray whale	1		98	18.0	1679	53	143	1629	
777	05-10-03	5				gray whale	2		107	20.0	1509	53	143	1389	
778	05-10-03	5				gray whale	2		128	15.0	2021	53	143	1454	
779	05-10-03	5				gray whale	2		132	3.5	11576	53	143	7746	
780	05-10-03	5				gray whale	1		125	4.0	9138	53	143	6897	
781	05-10-03	5				gray whale	3		118	4.0	9138	53	143	7576	Soc. behavior
782	05-10-03	4	16:03	0.25	Good	gray whale	1		85	18.0	1156	53	143	1154	
783	05-10-03	3	16:28	0.25	Good	gray whale	1		101	9.0	2036	53	143	1901	
784	05-10-03	3				Minke whale	1		62	5.0	3830	53	143	3643	
785	05-10-03	2	16:55	0.25	Good	gray whale	1		125	5.0	3491	53	143	2313	
786	05-10-03	1	17:27	0.25	Good										
787	07-10-03	2	9:33	0.25	Very goo	gray whale	2		160	5.0	3491	53	143	395	Young
788	07-10-03	2				gray whale	2		122	4.0	4527	53	143	3173	
789	07-10-03	2				gray whale	1		11	2.5	9336	53	143	3872	
790	07-10-03	3	10:39	0.25	Very goo	gray whale	3		125	2.4	13182	53	143	9321	
791	07-10-03	3				gray whale	1		52	4.0	4988	53	143	4404	
792	07-10-03	3				gray whale	1		73	7.0	2650	53	143	2630	
793	07-10-03	3				gray whale	1		64	7.0	2650	53	143	2547	
794	07-10-03	3				gray whale	2		58	5.0	3830	53	143	3551	
795	07-10-03	4	11:06	0.25	Very good										
796	07-10-03	5	11:35	0.25	Very goo	gray whale	1		136	7.0	4514	53	143	2779	
797	07-10-03	5				gray whale	4		52	12.0	2542	53	143	2156	
798	07-10-03	5				gray whale	2		145	10.0	3074	53	143	1490	
799	07-10-03	5				gray whale	1		102	7.0	4514	53	143	4293	
800	07-10-03	5				gray whale	1		135	6.0	5378	53	143	3385	
801	09-10-03	2	10:58	0.25	Very goo	gray whale	1		1	2.5	9336	53	143	2338	
802	09-10-03	2				gray whale	1		160	6.0	2857	53	143	323	
803	09-10-03	2				gray whale	1		155	5.0	3491	53	143	696	
804	09-10-03	3	13:08	0.25	Very goo	gray whale	4		120	5.0	3830	53	143	2934	Soc. behavior
805	09-10-03	3				gray whale	1		125	7.0	2650	53	143	1874	
806	09-10-03	3				gray whale	1		145	4.0	4988	53	143	2108	
807	09-10-03	3				gray whale	3		143	3.0	7453	53	143	3384	
808	09-10-03	3				gray whale	1		134	6.0	3128	53	143	1839	
809	09-10-03	3				gray whale	1		127	5.0	3830	53	143	2612	
810	09-10-03	3				gray whale	1		150	2.4	13182	53	143	4508	
811	09-10-03	3				gray whale	1		152	4.0	4988	53	143	1541	
812	09-10-03	3				gray whale	1		156	7.0	2650	53	143	641	
813	09-10-03	3				gray whale	1		150	5.0	3830	53	143	1310	
814	09-10-03	3				gray whale	1		152	4.0	4988	53	143	1541	
815	09-10-03	3				gray whale	1		155	2.4	13182	53	143	3412	
816	09-10-03	3				gray whale	1		152	2.4	13182	53	143	4073	
817	09-10-03	3				gray whale	2		155	4.0	4988	53	143	1291	
818	09-10-03	3				gray whale	3		155	5.0	3830	53	143	991	
819	09-10-03	3				gray whale	1		157	2.4	13182	53	143	2965	
820	09-10-03	3				gray whale	1		153	3.0	7453	53	143	2179	
821	10-10-03	1	8:54	0.25	Good	gray whale	3		55	6.0	1967	53	143	1824	
822	10-10-03	1				gray whale	1		38	5.0	2390	53	143	1857	
823	10-10-03	1				Minke whale	1		112	2.0	8764	53	143	7179	
824	10-10-03	2	9:28	0.25	Good	gray whale	2		107	4.0	4527	53	143	3901	

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825	10-10-03	2				gray whale	1		35	2.3	12536	53	143	9389	
826	10-10-03	2				gray whale	3		93	2.3	12536	53	143	12020	
827	10-10-03	2				gray whale	1		123	4.0	4527	53	143	3116	
828	10-10-03	3	9:59	0.25	Good	gray whale	3		107	9.0	2036	53	143	1814	
829	10-10-03	3				gray whale	2		112	4.0	4988	53	143	4230	
830	10-10-03	3				gray whale	1		120	2.4	13182	53	143	10098	
831	10-10-03	3				gray whale	1		115	6.0	3128	53	143	2562	
832	10-10-03	3				gray whale	4		20	5.0	3830	53	143	1915	
833	10-10-03	3				gray whale	1		23	20.0	903	53	143	492	Young
834	10-10-03	3				gray whale	1		5	7.0	2650	53	143	686	Young
835	10-10-03	3				gray whale	1		107	4.0	4988	53	143	4444	
836	10-10-03	3				gray whale	1		112	2.4	13182	53	143	11179	
837	10-10-03	3				gray whale	1		155	15.0	1208	53	143	313	
838	10-10-03	3				gray whale	1		38	4.0	4988	53	143	3707	
839	10-10-03	3				gray whale	1		42	4.0	4988	53	143	3931	
840	10-10-03	4	10:27	0.25	Very goo	gray whale	1		358	5.0	4451	53	143	504	
841	10-10-03	4				gray whale	1		50	4.0	5845	53	143	4984	
842	10-10-03	5	10:57	0.25	Very goo	gray whale	2		8	10.0	3074	53	143	744	
843	10-10-03	5				gray whale	1		5	6.0	5378	53	143	1026	
844	10-10-03	6	11:35	0.25	Very goo	gray whale	2		100	5.0	3830	53	143	3747	
845	10-10-03	6				gray whale	2		130	5.0	3830	53	143	2846	
846	10-10-03	6				gray whale	1		145	4.0	4988	53	143	2717	
847	10-10-03	7	12:06	0.25	Very goo	Minke whale	1		83	3.0	5819	53	143	5818	
848	10-10-03	8	12:32	0.25	Good										
849	10-10-03	9	13:01	0.25	Excellent										
850	10-10-03	10	13:27	0.25	Excellen	gray whale	1		37	2.0	4188	53	143	2521	
851	10-10-03	11	14:25	0.25	Good										
852	10-10-03	12	14:54	0.25	Good										
853	10-10-03	13	15:24	0.25	Good	gray whale	1	S fast	102	4.0	2249	53	143	2192	
854	10-10-03	14	15:54	0.25	Good	gray whale	1		116	1.3	5331	53	143	4570	
855	10-10-03	14				gray whale	2		80	1.8	3005	53	143	2993	
856	10-10-03	14				gray whale	1		108	2.0	2619	53	143	2411	
857	10-10-03	15	16:22	0.25	Good	gray whale	1		87	3.0	3689	53	143	3687	
858	10-10-03	16	16:52	0.25	Good	gray whale	1		107	2.0	4969	53	143	4726	
859	10-10-03	16				gray whale	1		115	3.0	2884	53	143	2592	
860	10-10-03	16				gray whale	1		74	5.0	1642	53	143	1586	
861	13-10-03	16	8:56	0.25	Good	gray whale	1		115	2.0	4969	53	143	4466	
862	13-10-03	16				gray whale	1		162	1.6	8788	53	143	2569	
863	13-10-03	16				gray whale	1		152	1.6	8788	53	143	3990	
864	13-10-03	15	9:35	0.25	Good	gray whale	3		130	3.5	3068	53	143	2316	
865	13-10-03	15				gray whale	3		132	1.8	9445	53	143	6907	
866	13-10-03	15				gray whale	2		129	1.8	9445	53	143	7235	
867	13-10-03	14	10:04	0.25	Good										
868	13-10-03	13	10:33	0.25	Good										
869	13-10-03	12	11:04	0.25	Good										
870	13-10-03	11	11:33	0.25	Very goo	gray whale	1		98	2.0	7897	53	143	7739	
871	13-10-03	11				gray whale	1		62	2.0	7897	53	143	7186	
872	13-10-03	10	12:00	0.25	Very goo	gray whale	3		140	1.5	8095	53	143	5204	
873	13-10-03	9	12:30	0.25	Very good										
874	13-10-03	8	12:56	0.25	Very goo	gray whale	1	N	112	2.5	3202	53	143	2890	
875	13-10-03	6	14:15	0.25	Good	gray whale	1		35	4.5	4326	53	143	2604	
876	13-10-03	5	15:06	0.25	Good	gray whale	1		155	18.0	1679	53	143	547	
877	13-10-03	5				gray whale	4		38	10.0	3074	53	143	2135	
878	13-10-03	5				gray whale	1		152	13.0	2341	53	143	877	
879	13-10-03	5				gray whale	1		45	10.0	3074	53	143	2389	
880	13-10-03	5				gray whale	1		41	9.0	3436	53	143	2513	
881	13-10-03	5				gray whale	1		145	5.0	6706	53	143	3251	
882	13-10-03	5				gray whale	2		18	8.0	3899	53	143	1586	
883	13-10-03	5				gray whale	1		22	43.0	698	53	143	328	
884	13-10-03	5				gray whale	1		38	4.5	7701	53	143	5349	

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885	13-10-03	5				gray whale	1		92	33.0	911	53	143	902	
886	13-10-03	5				gray whale	1		13	7.0	4514	53	143	1470	
887	13-10-03	5				gray whale	2		15	10.0	3074	53	143	1102	
888	13-10-03	4	16:07	0.25	FR	gray whale	2		48	5.0	4451	53	143	3712	
889	13-10-03	4				gray whale	1		60	13.0	1608	53	143	1496	
890	13-10-03	4				gray whale	1		64	3.0	9036	53	143	8618	
891	13-10-03	4				gray whale	1		40	4.0	5845	53	143	4378	
892	13-10-03	4				gray whale	1		90	20.0	1039	53	143	1028	
893	13-10-03	4				gray whale	1		40	8.0	2657	53	143	1990	
894	13-10-03	3	16:35	0.25	FR	gray whale	1		87	5.0	3830	53	143	3802	
895	13-10-03	3				gray whale	1		58	10.0	1826	53	143	1693	
896	13-10-03	3				gray whale	1		60	25.0	721	53	143	678	
897	13-10-03	3				gray whale	1		77	8.0	2302	53	143	2299	
898	13-10-03	3				gray whale	1		58	5.0	3830	53	143	3551	
899	13-10-03	2	17:19	0.25	FR	gray whale	1		37	7.0	2423	53	143	1870	
900	13-10-03	2				gray whale	1		148	6.0	2857	53	143	906	
901	13-10-03	2				gray whale	1		130	5.0	3491	53	143	2077	
902	13-10-03	2				gray whale	1		146	6.0	2857	53	143	1000	
903	13-10-03	1	17:53	0.25	FR										